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THE UTILITY OF HIGH RESOLUTION MODELING IN ARMY SPECIAL OPERATIONS AVIATION MISSION PLANNING

by

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The purpose of this thesis is to explore the application of high resolution modeling in the Army Special Operations Aviation mission planning process. This thesis looks at the unique missions Special Operations Forces are expected to perform, often at very high levels of public scrutiny, and how the use of combat simulation can assist commanders, planners and staffs in simplifying the frictions encountered in the planning process. The main objective of this study is to define common practical uses for combat simulation in deliberate and time sensitive mission planning.

This investigation surveys the use of special operations to achieve key foreign policy objectives and the ability of combat simulation to provide answers to potential questions and to stimulate queries to subjects that operators may not have considered germane to the outcome of the mission. By applying combat simulation in the mission planning process, planners can streamline decision making capabilities by constructing correct and visible paths to valid conclusions. An historical case study, the raid on the Son Tay prisoner of war camp in North Vietnam in 1970, serves as a instructive example to demonstrate basic applications of combat simulation in the mission planning process and investigating variables possibly cogent to the outcome of the mission.

Finally, a discussion on high resolution special operations models used at the United States Special Operations Command and their architecture for future mission planning modeling will assist in spanning the chasm from the Cold War paradigm to new and unexpected tactical scenarios.

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THE UTILITY OF HIGH RESOLUTION MODELING IN ARMY SPECIAL OPERATIONS AVIATION MISSION PLANNING

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A French proverb declares: Gratitude is the heart's memory. I would be extremely ungrateful if I did not thank those who have given so much to make this project tolerable if not somewhat enjoyable. I want to thank Bard Mansager for believing in high resolution modeling. His passion was contagious. I appreciate Professor Maurice Weir's refining editorial touch to this thesis. Thanks to Jennifer Duncan and Gordon McCormick for allowing me to travel and conduct research. To John Cox, thanks for your insight and desire to get modeling into the hands of warriors. Thanks to Kenny McMullin, a Son Tay raider and American hero for his willingness to try. Heartfelt thanks to Lt.Col. Larry Chesley, a POW in North Vietnam for almost seven years and a Son Tay resident, for his vivid recollection of what must have been hell on earth. Thanks to Bob Wilson for his expert advice on combat simulation. Thanks to MAJ John Buss for his superb logistical support. To my wife April and children Patrick, Ira, Harrison and Kalee, thanks for your understanding and patience while I camped behind the computer. I will never be able to repay you for your devotion to me. Finally, to all Night Stalkers who put it on the line every time you strap in. May you continue to set the night-flying standard and return safely home. **NSDQ**

EXECUTIVE SUMMARY

One of the greatest quests of the prolific Prussian military strategist Carl von Clausewitz was to answer the question: "How can we analyze war?"[1] This pursuit continues today as special operations (SO) commanders, staffs, and planners strive to understand the critical variables which can curtail the success of the best planned special operations missions.

The purpose of this thesis is to explore the heuristic application of high resolution modeling in the Army Special Operations Aviation (ARSOA) mission planning process. One of the main objectives of this study is to define common practical uses for combat simulation in deliberate and time sensitive mission planning.

Because ARSOA normally works in support of Special Operations Forces (SOF) to include Special Forces, Rangers, and Navy SEALS, mission planning must be precise, complete and in perfect harmony with the supported component.

SOF is expected to perform, with a high degree of success, unique and politically sensitive missions, often at very high levels of public scrutiny. The use of combat simulation can

[1] See Peter Paret, "Clausewitz", *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, (Princeton, NJ:Princeton University Press) pp. 186-213.

assist commanders, planners and staffs in simplifying the frictions of war[2] often encountered in the planning process.

In Chapter I the investigation surveys the use of SO to achieve key foreign policy objectives and the ability of combat simulation to provide answers to potential questions and to stimulate queries to subjects that operators may not have considered germane to the outcome of the mission. By applying combat simulation in the mission planning process, planners can streamline decision making capabilities by constructing correct and visible paths to valid conclusions.

Chapter II surveys basic concepts of modeling and simulation and their use for better comprehension of complex systems. It would be extremely impractical if not criminal for researchers to test the destructive capabilities of rocket propelled grenades (RPG) on helicopters in different flight profiles. The mathematical modeling process simplifies such complex "real world" phenomenon. This process consists of the following four steps:

1. Make specific observations about the behavior being studied and make simplifications.

2. Conjecture relationships among the factors.

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[2] Paret, *Makers of Modern Strategy*, describes Clausewitz's "friction" as "uncertainties, errors, accidents, technical difficulties, the unforeseen, and to their effect on decisions, morale, and …is everywhere in contact with chance…it is the force that makes the apparently easy so difficult." pp. 202-203.

3. Apply mathematical analysis to the consequent "model".

4. Explain mathematical conclusions in terms of the real-world puzzle.[3]

High resolution combat models cache the parameters of the real-world data to simulate the environment through the use of mathematical algorithms and functions. From this process we can perform analysis and "see" the high resolution modeling results. Warfighters can tap into this "electronic sand table" to review and identify critical nodes in a mission.

Chapter III discusses the high resolution model, Janus, used for the analytical portion of this thesis. Janus is an interactive war gaming simulation primarily designed for ground maneuver units. It does model aircraft weather, day and night visibility, engineer support and a chemical environment. This model was used because of its availability at the Naval Postgraduate School (NPS). It is not within the scope of this thesis to argue the viability of Janus as a SOF model. It does have weaknesses but also has illustrative qualities.

Chapter IV surveys joint doctrine mission planning guidance for SOF forces and their role within the broader conventional scope of war.

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[3]Frank R. Giordano & Maurice D. Weir, *A First Course in Mathematical Modeling* (Monterey, CA:Brooks/Cole Publishing Company, 1985) pp. 30-31.

Chapter V applies the concepts of modeling and planning in a demonstrative case study, the raid on the Son Tay prisoner of war camp in North Vietnam in 1970. This serves as an instructive example to illustrate basic applications of combat simulation in the mission planning process and to investigate variables possibly cogent to the outcome of the mission.

Finally, Chapter VI provides a discussion on high resolution SO models used at the United States Special Operations Command (USSOCOM) and the command's proposed architecture for future mission planning-modeling, Mission Planning, Analysis, Rehearsal, Execution (MPARE) System, which will assist in spanning the chasm from the Cold War paradigm to new and unexpected tactical scenarios. MPARE will allow SOF war-fighters to "pull" critical information from a broad spectrum of sources by implementing sophisticated browsing tools. Combat modeling will be incorporated into the architecture. Combat modeling's additional SOF applications include:

- Historical case library
- Electronic sand table
- After action tool
- Wargaming tool
- Mission preview platform
- Enemy and friendly order of battle database

The employment of combat modeling in the actual detailed planning will require a paradigm shift for SOF commanders, staffs and planners. We are presently in a transition period in which new technological aids may not be readily accepted. Old habits are hard to break. The Assistant Secretary of the Army for Research, Development and Acquisition, a former Army aviator stated:

> …I believe the main message is that simulation is like software and computing power. When software and computing power became used routinely by everyone, it revolutionized the world, moving it from an industrially-based world to an information-based world. I think simulation is the aggregation of this technology. It offers great insight where we might be in the future…Simulation will revolutionize our thinking and certainly have a major impact on our military operations.[4]

While ARSOA and SOF planning is already extremely detailed and sophisticated, combat simulation may offer the edge which will overcome the assumptions and uncertainties of SO.

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[4] Gilbert F. Decker, Assistant Secretary of the Army for Research, Development and Acquisition, made these comments at the Army Aviation Association of America Simulation Symposium, September 6, 1996.

I. INTRODUCTION

"Yes, we have slain the dragon. But now we live in a jungle filled with a bewildering variety of poisonous snakes. And in many ways, the dragon was easier to keep track of."
James Woolsey
Former Director of the CIA after the end Of the Cold War

A. PURPOSE

The intent of this research is to discuss the utility of **HIGH RESOLUTION COMBAT MODELING**[1] as an analytical tool in **ARMY SPECIAL OPERATIONS AVIATION (ARSOA)** mission planning. Subordinate commanders of **SPECIAL OPERATIONS** (SO) are given a great amount of latitude to plan missions in support of the Special Operations Command (SOC) commander's mission guidance and intent.

Joint special operations doctrine requires great flexibility in anticipation of a rapidly changing environment during mission planning. Comprehensive and detailed mission planning, based on specific and accurate tactical intelligence, is vital to successful mission execution and also to the very survival of the operational element.[2]

[1] Definitions of bold and capitalized terms found in glossary.
[2] Joint Chief of Staff. Joint Pub 3-05. *Doctrine for Joint Special Operations*, Washington DC: Joint Chiefs of Staff, 1992.

There are two types of mission planning: deliberate and time-sensitive. Deliberate planning involves relying on assumptions regarding the environment that will exist when the plan is executed. The situation does not yet exist. The commander, special operations command (COMSOC) is responsible for all levels of deliberate planning in the form of theater-level operational plans (OPLANS) and conceptual operational plans (CONPLANS).

Time-sensitive planning concerns itself with the deployment and resources of forces in response to an actual situation. The COMSOC also actively deals with all elements of time-sensitive planning at the theater level. Successful mission planning, whether it be deliberate or time sensitive, is dependent on the quality and thoroughness of mission planning preparedness. Both types of planning will be discussed in detail in Chapter IV.

The application of high resolution combat simulation modeling in the commander's planning process, whether deliberate or time-sensitive, which if thoughtfully used, can allow the COMSOC or his **MISSION PLANNING AGENT (MPA)**, greater vision of mission objectives and better understanding of critical nodes of the operation.

B. OBJECTIVES

The primary focus of this thesis is to explore the utility of high resolution combat simulation modeling in ARSOA mission planning. This thesis addresses issues that will enhance the ARSOA commander and his staff's understanding of modeling as a tool and resource for mission analysis, course of action (COA) selection, mission sensitivity analysis, and after action review (AAR) enhancement.

The main objective of this research is to explore the potential validation of high resolution combat simulation modeling in ARSOA mission planning.[3] While this paper will emphasize high resolution modeling and its employment within the ARSOA mission planning cycle, its applicability goes beyond aviation specific special operations forces (SOF) mission planning and analysis. (Special Forces teams are currently exposed to modeling at the Joint Readiness Training Center [JRTC] for training and course of action selection). Because ARSOA planners must work closely with supported SOF assets, planning and analysis must be unified and mutually supportive.

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[3] This thesis has been influenced by the research of Lt. Jeff Hakala, USN, *Combat Simulation Modeling in Naval Special Warfare Mission Planning*, 1995. My research is in great part an extension of his work and its applicability to ARSOA mission planning.

The integration of high resolution combat simulation modeling as an analytical tool in the hands of commanders and MPAs requires tactical vision, confident implementation, and hands-on utilization and experience in training scenarios in preparation for real-world missions and contingencies. While tactical modeling and simulation in the hands of warfighters as an analytical mission planning tool will be readily available in the future, a clear understanding of its potential is critical for its impending successful implementation in the future. This paper is intended to acquaint and inform readers with the potential tactical uses of combat simulation modeling which has here to fore been relegated primarily to the role of a training instrument.

C. BACKGROUND DISCUSSION

Conventional military downsizing, largely due to the demise of the former Soviet Union, may well increase the employment of SOF assets. The increasingly anarchic international system, as compared to the bi-polar Cold War era, may demand the utilization of well-trained SOF "packages" when large conventional battalions or battle groups may be viewed as politically incorrect or overkill. Regional hot spots such as Somalia, Haiti, Burundi, Liberia

and Bosnia have all recently required the unique capabilities offered by SOF.

U.S. SOF differ from general forces not only in employment, but also differ in equipment, training and size (see Figure 1).

	Special Operations Forces	General-Purpose Forces
Personnel	Exceptional Motivation and Ability	National average
Equipment	Highly modified, uniquely procured	Standardized
Training	Joint, often with foreign forces	Service, usually with national forces
Size	Groups, regiments, wings	Armies, numbered air forces, fleets

Figure 1: Force Characteristics - SOF and General Purpose Forces[4]

Shrinking budgets, manpower constraints, and new and unexpected threats will increase the demands placed on SOF. H. Allen Holmes, Assistant Secretary of Defense for Special Operations and Low Intensity Conflict (ASDSOLIC) said, "...the number one priority... is to insure that the extremely valuable resource, the SOF community, is properly used in the pursuit of our national foreign policy and security-policy objectives in the new global environment."[5]

As the post-Cold War era challenges almost every aspect

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[4] Bruce Pirnie, *Analysis of Special Operations Forces in Decision Aids*, (Santa Monica, CA:RAND, 1994) p. xi.
[5] H. Allen Holmes interview, Assistant Secretary of Defense for Special Operations and Low Intensity Conflict, in *Special Warfare*, 1994, Vol. 7, No. 4, p. 46.

of our lingering Cold War military, a new vision must be incorporated into every facet of modern military affairs. In an introduction to a joint services publication on modeling and simulation, General John M. Shalikashvili remarked:

> As we downsize our forces and face new, evolving threats to our nation's security, the well-worn phase "do more with less" will become a way of life for us. Resourcefulness and imagination, key ingredients of successful military operations, will play greater roles in how we go about our business.[6]

U.S. Army Special Forces, Rangers and Navy SEALs rely on ARSOA assets who are highly trained. ARSOA specializes in tactics of infiltration and exfiltration, light attack, assault, and resupply of SOF by clandestine and covert penetration of hostile or denied airspace. They perform this with precision over extended ranges, and on properly equipped aircraft, during adverse flying conditions (limited ceiling and visibility).[7]

ARSOA are often very unique because their wide-ranging capabilities allow the National Command Authority (NCA) great latitude and flexibility in employment options along

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[6] The Chairman of the Joint Chiefs of Staff made these remarks in *Joint Modeling and Simulation Evolutionary Overview*, February 1994.

[7] CW4 Chuck Goering, "Introduction to Special Operations Aviation", an informal unit introduction document produced by 2nd Battalion, Special Operations Aviation Regiment (SOAR) Airborne.

the ever-increasing world-wide special operations continuum. Such missions have received the attention of a large international audience.

In today's world of instantaneous global news coverage, the visibility of SOF assets may be anything less than covert. The repercussions of alleged failure may border on a near "zero-defect" status. The Battle of Mogadishu serves as an excellent example of SOF leadership not only contending with a hostile force but a scrutinizing media. The ramifications of apparent failures in Mogadishu were instantly transmitted to population centers around the world. Such mission transparency puts enormous pressure on SOF commanders and on the NCA to negotiate successfully this country's foreign policy.

The demands on ARSOA commanders and staffs to perform in a very unforgiving public environment requires the skillful utilization of all available resources to successfully plan, rehearse and execute ARSOA missions. Modeling and simulation can be valuable tools in the tool kit of operational planners and staffs. It is no longer a luxury to utilize technology in the execution of SOF mission planning. An understanding of its potential usefulness can reap great rewards in the execution of ARSOA missions.

D. AUDIENCE

This paper is written primarily for those familiar with ARSOA mission planning and SO doctrinal terms and concepts as found in Joint Pubs 3-05, 3-05.3 and 3-05.5.[8] Also included are modeling and simulation definitions necessary for an integrated understanding of simulation modeling as an analytical tool in ARSOA mission planning.

E. RESEARCH DESIGN

The design of this research is based on a premise that few readers have been exposed to the benefits of high resolution combat simulation modeling when applied to tactical aviation planning, whether deliberate or time--sensitive. To facilitate the reader's introduction to the research design, an overview of the mathematical modeling process in simulation is included. Using this discussion as a basis for understanding, the investigation will provide a general overview of the concepts, attributes and limitations of combat modeling as it applies to SOF and, more specifically, ARSOA mission planning. The central point of this paper is to consolidate the abstract concepts of simulation modeling and to bridge the chasm of

[8] Joint Pub 3-05 *Doctrine for Joint Special Operations*, 1992, Joint Pub 3-05.3 *Joint Special Operations Operational Procedures*, 1993, and Joint Pub 3-05.5 *Joint Special Operations Targeting and Mission Planning Procedures*, 1993.

understanding between modeling and mission planning. The Janus 6.0 High Resolution Combat Model demonstrates the applicability of combat modeling in enhancing the ARSOA planning process.

Janus is an interactive war gaming simulation. It was the tool used for illustrative purposes and was selected for this study because of its accessibility at the Naval Postgraduate School. Moreover, this simulation model has been used in one version or another in the Army since 1973 and contains most of the attributes found in other military simulations including the Joint Conflict Model(JCM) and Joint Tactical Simulation Model(JTS). These models evolved from Janus and are in use at the United States Special Operations Command (USSOCOM). These specific simulations will be discussed in detail in Chapter VI. Weaknesses of Janus will also be discussed in regard to ARSOA mission planning. As primarily a ground maneuver based model designed for brigade and battalion level operations, Janus also models weather, day and night visibility, engineer support, indirect artillery fire, minefield employment and breaching, rotary and fixed wing aircraft, resupply, and chemical environment.

There are drawbacks and limitations to utilizing Janus for ARSOA mission planning. Understanding these limitations is important and do not degrade the sound reasons for this

research. Such a model can be used to construct correct paths from premises to conclusions.[9] It also allows questions to surface which may otherwise have gone unasked. This paper underscores the generic application of modeling in the ARSOA planning process and the benefits of model use. Janus is used as a baseline for discussion and conceptualization of definitive points regarding high resolution modeling in ARSOA mission planning. Such investigative discussion facilitates the modification of existing, or the development of new models specifically designed for SOF aviation missions. Future combat modeling systems will also be discussed in chapter VI. Janus is not a panacea for the ARSOA mission planner. Yet, by utilizing it in this research to explore its benefits and uncover its drawbacks when applied in the ARSOA mission planning process, it can be used as a stepping stone to future ARSOA combat models.

F. ORGANIZATION

This paper is divided into six chapters including the introduction. Following the introduction, Chapter II addresses the background of modeling and simulation within

[9] See James S. Hodges, "Six (or so) Things You Can Do with a Bad Model, *Operations Research*, Vol. 39, No. 3, pp. 355-365, May-June 1991

SOF and the military. Chapter III provides an overview of Janus and its various functions. Chapter IV discusses SOF doctrinal tenets and the implications of combat modeling in the ARSOA mission planning process. Chapter V looks at the application of high rersolution modeling and SOF planning on an historical case study: the attempted rescue of prisoners of war (POWs) in North Vietnam in 1970 during the Son Tay Raid or "Operation Kingpin". The future of SOF combat modeling, along with recommendations and conclusions, is explored in the final chapter.

II. SIMULATION MODELING

"If I always appeared prepared, it is because before entering an undertaking, I have meditated for long and have foreseen what may occur. It is not genius which reveals to me suddenly and secretly what I should do in circumstances unexpected by others, it is thought and preparation."
Napoleon Bonaparte

Simulation modeling can be a powerful tool to better understand complex systems. It allows users to create models of real-world processes which are too complex to be analyzed by spreadsheets, flowcharts or diagrams. It is a cost effective and efficient communications tool to show how an operation or process works while stimulating creative thinking about how the operation can be improved.

A basic understanding of mathematical modeling is important for understanding the applicability of combat simulation modeling.

A. MODELING

A model can be something as elementary as a simplified representation of the entity it imitates or simulates.[10] A model can also be described as a "logical description of

[10] *Military Modeling*, ed., Wayne P. Hughes, Jr., The Military Operations Research Society, 1989, p. 1.

how a system, process or component behaves."[11] Instead of interacting with the real system, a model can be constructed to portray certain aspects of a real-world situation. A representative example is the board game Monopoly. This game is a model of a real system: the hotels and facilities of Atlantic City. A player must negotiate the modeled world of the Atlantic City real estate domain. The player assumes the risks and ventures of a business person using fictitious money, property, utilities possibly incurring jail time. The model allows the player to learn, experiment and experience with out really risking "real" money, incarceration or bankruptcy. This type of model is only as good as the ability of the player to learn from the experience.

If an MPA wanted to better understand a specific phenomenon (for example, the relationship between an RPG effectiveness on a UH-60 helicopter at different distances and altitudes in different types of terrain and visibility), a model can be used to explore the possibilities. It would be extremely impractical to submit multimillion-dollar aircraft to the firepower of RPG projectiles to better understand the destructive outcomes. A model can be

[11] Definition located on the Internet at http://www.imaginethatinc.com/aboutsim.htm

developed to test certain hypotheses and make predictions based on the user's analysis.

Models, in particular **COMBAT MODELS**, can give the user a feel for the terrain and the ability to "visualize" the conduct of operations on that terrain. This is a valuable asset for the mission planner to utilize an "electronic sand table" to develop, review, and identify critical nodes in operations.[12] The prohibitive costs of utilizing real aircraft and crews to experiment with the effects of RPGs versus UH-60 helicopters is self explanatory as to why models are needed.

Frank R. Giordano and Maurice D. Weir describe models as mathematical constructs designed to analyze a particular real world system or phenomenon (see Figure 2). Weir and Giordano define a system, that behavior which a model attempts to capture or represent, as "an assemblage of objects joined in some regular interaction or interdependence."[13] Systems, by the nature of this definition, are important to the MPA who incorporates modeling into the mission planning equation.

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[12] This concept is attributed to Professor Bard Mansager, an expert in mathematical modeling at the Naval Postgraduate School and a advocate of modeling at the warfighter level.

[13] Frank R. Giordano and Maurice D. Weir, *A First Course in Mathematical Modeling*, (Monterey, CA: Brooks/Cole Pub. Co., 1985) p.30.

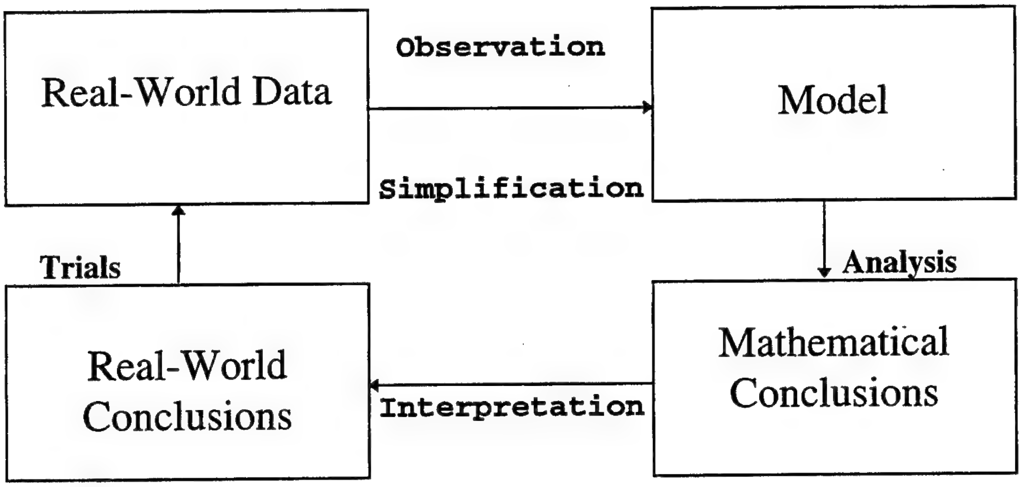

Figure 2: Modeling Process
(Data from Giordano and Weir, p. 30)

On the left side of Figure 2, "Real-World Data" is an observation made by the MPA, mission planner, staff or commander. The planner gathers information to begin formulation of the model. This process is based primarily on the knowledge of the issues pertaining to the "mission" or contingency operation. Assumptions play a large role in the cognitive process.

A combat model should be assessed by how well it allows the planner to understand the variables of the mission and through utilizing the model to make predictions or offer explanations. This process will be demonstrated in Chapter V which as the use of modeling as an "electronic sand table" is illustrated during the mission planning process.

The precision or exactness of the model's representation of the "real-world" is critical to assessing

its validity or effectiveness. Versatility is also an essential property of a model. The MPA must be able to continually update data and control conditions to accurately portray the modeled phenomenon. These attributes allow models to be tools not only for predictive power but for "description and understanding."[14]

B. SIMULATION

A simulation does more than depicting a phenomenon; it imitates it. The Simulation Network (SIMNET) at Fort Rucker, Alabama is a battle simulation which looks at the combination of men, tanks, fixed and rotary aircraft, together with their interrelationships and composite effects on the battlefield.

Simulation can also involve designing a model of a system, process, or component and carrying out experiments on it. Simulation allows the "operator" to "what if" the experiments to determine how the real system performs and to predict the effect of changes to the system. For example, simulation can help aviators answer the following questions:

- What are the proper procedures to handle specific life threatening in-flight emergencies?
- When flying under instrument flight rules (IFR) and you encounter a dual generator failure, what are the ramifications?

[14] Wayne P. Hughes, *Military Modeling*, p. vii.

- If a specific catastrophic maneuver is expected in the crash of an aircraft, can that maneuver be duplicated in a simulator to test hypotheses?

This type of simulation is an abstract of or based on a real asset. An example would be an aircraft simulator versus the real item.

Army Aviation has long been in the forefront of simulation as an extremely beneficial asset in training and maintaining pilot proficiency. While such simulation is an abstraction, it can be a powerful abstraction if it is wisely employed. Some situations must be rehearsed in a simulator; they are just too dangerous to try out in an aircraft during actual flight. When aviators use simulation (cockpit simulators) to rehearse potentially catastrophic emergency situations (i.e. dual engine failure at max gross weight or fire), powerful and enduring lessons can be learned. Such reliance on simulation is critical to pilot proficiency. The hours spent in a simulation device can save time, money and lives.

There are basically three types of combat simulations: **LIVE SIMULATION**, **VIRTUAL SIMULATION**, and **CONSTRUCTIVE SIMULATION.** MG Ronald E. Adams, Branch Chief and Commanding General, U.S. Army Aviation Center called for a need to balance the use of all three. Presently, live simulation accounts for approximately 80 percent of

conventional aviation flight hours. Virtual simulation amounts to approximately 15 percent, while the cost of constructive simulation accounts for five percent.[15]

Live simulations are costly, not only in flight hour dollars, but in maintenance time and repair costs as well. While it is critical and essential to maintain a high degree of proficiency, MG Adams claims virtual and constructive simulation can pay great dividends.[16] The Army Aviation Branch Chief stated that the goals for simulation training and implementation of greater virtual and constructive simulation be increased (see Figure 3).

[15] MG Adams made these remarks during the keynote address at the first Army Aviation Association of America(AAAA) Simulation Symposium on August 5, 1996 in Alexandria, Virginia. In a speech entitled "The Future Of Army Simulation is Now", MG Adams called for advance simulation studies and improvement at the user level.

[16] A recent preliminary study (May 1996) conducted at the Army Research Institute exposed one group of flight students to 7.5 hours of basic maneuver simulation training prior to initial flights in the actual aircraft. Another group went directly to the flight line without the simulation hours. Students with the simulation training soloed sooner (average 6.0 hours sooner) and were "put up" for check rides on an average 8.0 hours sooner than their counterparts without simulation.

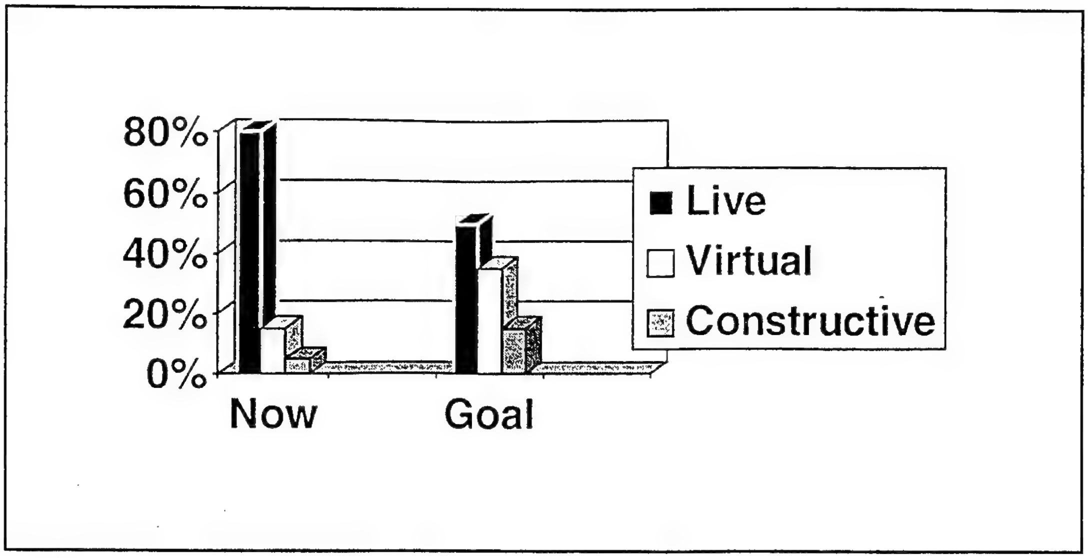

Figure 3: Current and Future Goals of Army Aviation Simulation

C. WAR GAMING

The term "war gaming" has multiple connotations. Joint Pub 1-02, Department of Defense Dictionary of Military and Associated Terms, defines a war game as "a simulation by whatever means, of a military operation involving two or more opposing forces, using rules, data, and procedures designed to depict an actual or assumed real life situation."[17] War gaming can also infer the non-destructive simulation of armed combat. It does not mean it is the actual play, but the study of how to successfully wage war with the appropriate resources.[18] "War gaming involves a replication of warfare without combat, which allows

[17] Joint Publication (Pub) 1-02, Department of Defense Dictionary of Military and Associated Terms, 1 December 1989, p. 393.
[18] From the Internet: http://www.wpc.af.mil/cax.html

opponents to repeatedly respond to each others varied thrusts. By studying the results, they can improve their combat skills, and using this knowledge they become more likely to win."[19]

War gaming can also be viewed as a distinctive break from an actual exercise (live simulation). War games are intended to exercise the human mind and its application of essential forces without applying the actual resources required. As an example, an entire joint special operations task force (JSOTF) and its functions could be a desired level of a war game. The support organizations, however, such as ARSOA aircraft and crews, Navy SEAL teams, or special electronic warfare assets would be simulated.

Classical war games are not just the demanding and detailed analysis of a particular problem or contingency, but also "an exercise in human interaction, and the interplay of human decisions and the outcomes of those decisions make it impossible for two games to be the same."[20]

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[19] Ibid.

[20] Peter P. Perla and LCDR Raymond T. Barrett, *USN War Gaming and its Uses, Center for Naval Analysis* (CNA) Professional Paper 429 (Alexandria, VA: Center for Naval Analysis, 1984) p. 2; Ralph E. McDonald, *Cohesion, The Key to Special Operations Teamwork,* (Maxwell Air Force base: Air University Press, 1994) pp. 44-53.

Today, the simulation and war gaming processes are becoming almost indistinguishable. Yet, while ARSOA is extremely active in exercising the training benefits of simulation, there is a lack of participation in SOF war gaming, especially at the tactical level. Some ARSOA crew members may contend that free-play live simulations accomplish the same objectives as war games. While this rationale may be true in some cases, exercises are extremely costly in personnel and equipment requirements. While war gaming would allow shrinking flight hours and escalating maintenance requirements to be utilized more efficiently, aviation crews would require an attitudinal paradigm shift. Aviators want to fly.

While free-play live simulation exercises have been the prime source of training in the past, the ability to stop or control time in order to review and explore issues, is difficult to do once the exercise begins.

ARSOA "must further explore and exploit war gaming educational opportunities, especially in the tactical environment."[21]

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[21] McDonald, *Cohesion, The Key to Special Operations Teamwork*, p. 53.

III. JANUS

"No study is possible on the battlefield."
Ferdinand Foch

"Fortune favors the prepared mind."
Louis Pasteur

A. JANUS OVERVIEW

Janus is an interactive, high resolution war gaming simulation named for the two faced Roman god who was the guardian of portals and the patron of beginnings and endings. The current version, Janus 6.0, is a six-sided, closed, **STOCHASTIC**, ground combat simulation featuring precise color graphics. "Interactive" refers to the interplay between the military personnel, who decide what to do in crucial situations during simulated combat, and the systems that model the combat. "Six-sided" refers to the number of sides which may be simulated at once. "Closed" means that the nature of opposing sides is largely unknown to players in control of a side. "Stochastic" refers to the way the system determines the results of direct fire engagements, according to probability and chance.

While Janus is primarily a simulation model designed for ground maneuver assets, it also models weather, day and night visibility, engineer support, minefield employment, breaching, rotary and fixed wing aircraft, resupply,

and a chemical environment. This thesis focuses on the rotary aircraft aspects of the model with some discussion on fixed wing aircraft.

Janus uses digitized terrain developed by the Defense Mapping Agency (DMA), portraying the terrain in a form familiar to military users, with contour lines, roads, rivers, vegetation, and urban areas. Fences, buildings and generic areas (such as swamps or no-go areas) can also be displayed. Generic strings such as pipelines, power lines, rail lines and berms can be exhibited as well.

Colors are slightly different than those used on military maps: contour lines are brown, rivers and bodies of water are blue, roads are brown or gray with white outlines, urban areas are yellow, and vegetation is green. Fences are red, and generic areas and strings can be portrayed in various colors. [An important note: terrain realistically affects visibility and movement.]

Janus allows the user to portray each individual system (e.g., a tank, or aircraft) with an icon. A planner can then "analyze and modify the actions of an individual combat process and collect the data from the resultant outcomes."[22] Individual icons can represent any number of same system objects. A squad, platoon or company can all be depicted

[22] Hakala, *Combat Simulation Modeling in Naval Special Warfare Mission Planning*, p. 14.

with a single icon and their actions can be altered, observed and or quantified.

Like most other simulation models, Janus allows the user to simplify complex probabilistic behavior. Janus simulation can act as an architecture for understanding the complexities of SOF mission planning. The mere process of modeling can act as a stimulus to intuitive thought processes during the mission planning process. Chapter V explores conceptual applications of modeling within a mission planning scenario.

Janus is not a SOF specific simulation. Modeling tactical ARSOA missions in a predominantly low-level, "zero" illumination aviation environment is less than ideal. Certain ARSOA specific missions, including amphibious support operations, are difficult to portray realistically. Janus was not intended to analyze such specific operations; its initial development was designed more for battalion and brigade size operations.

Another weakness in using Janus is the limited options for flight envelopes. Users can only distinguish between Low/Slow (Nap-1) or High/Fast (Nap-2) options during route execution. Altitudes and velocities (flight speeds) can be adjusted in the database for each aircraft. However, once

the simulation starts, altitudes and airspeeds cannot be adjusted (which takes away from human judgment inputs).[23]

The Janus simulation also uses the Universal Transverse Mercator (UTM) versus latitude and longitude. Most ARSOA flight planning uses 1:500,000 for long-range non-tactical flying; Joint Operation Graphic (JOGs) for planning and flying the enroute portion; and 1:50,000 tactical maps for objective location. The user must mentally, or with the use of a computer program, convert from UTM to latitude and longitude for pin point accuracy.

While Janus 6.0 does model the human element, it lacks the detail and sophistication requisite for SOF, specifically ARSOA operations, where the interaction of various human decision-making processes affect the survivability of ARSOA specific platforms (MH-47s, MH-60s, and MH-6s). Janus 6.0, for example, now allows individuals mounted on a unit (aircraft, landing craft, trucks, etc.) to fire at an acquired target while still mounted on that unit. So, an MH-6 helicopter with SF soldiers riding on the skids, could fire at an adversary while still mounted. Yet, the pilot of the aircraft, if he encounters a threat, cannot perform evasive maneuvers outside of his preplanned route profile. SOF models need more detail to better simulate complex tactical situations. While few combat simulations

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[23] See *Database Manager's Guide*, pp. 76-77.

effectively model individual tactical play, this feature would need to be enhanced to effectively support extensive ARSOA use.

While specific strengths and weaknesses of the Janus model are not thoroughly addressed in this thesis, high resolution modeling in general is discussed as a valuable tool for mission planning.

B. SIMULATION: MONTE CARLO STYLE

Most simulation models are either deterministic or probabilistic. Deterministic models assume that every event, act, or decision is the inevitable consequence of happenings that are independent of the human will. Lanchester Combat Models are representative of deterministic models, where the results are determined by mathematical formulae which are not subject to probability distributions. The outcomes in deterministic models are constant and not subjected to randomness. The exact same outcomes will occur under the exactly same conditions. Processes with an element of chance, such as flipping a coin or rolling dice, are probabilistic and more accurately capture human involvement.

Most military models are probabilistic, using Monte Carlo simulation; Janus is no exception. This type of simulation involves computers with the capacity to store

measurements associated with real-world systems from a simulated environment using probabilistic algorithms and functions. (A detailed discussion of the technical intricacies of the Monte Carlo simulation process is beyond the scope of this paper.) Finalized data so generated is used for analysis and explanation of the simulated behavior. The Monte Carlo process is especially useful in the analysis of a complex probabilistic conduct, such as a combat mission.

1. The Stochastic Process

Microsoft Bookshelf defines the term "stochastic" as "involving or containing a random variable or variables; involving chance or probability." Monte Carlo simulation is often considered synonymous with stochastic simulation, signified by an element of randomness to the particular outcome of a particular event.[24] The generation of this randomness is key to successful combat modeling.

It is impossible to account for every factor associated with a particular occurrence in the real-world. The best trained football teams in the country account for as many variables as possible when they run a given play. Each offensive player has a specific role to perform during the execution of the play. Yet, the same play run time and again

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[24] Hakala, p.11

under the same conditions will most likely yield different results. Why? Differences in offensive timing, subtle changes in temperature, unaccounted for defensive reaction, minute changes in player positioning, etc. all account for differences in the outcome. While most plays are designed, if executed per plan, to score touchdowns, so many variables are involved that account for the one in ten (or for some teams one in a thousand) plays which actually result in a score.

A simulation reproduces these random effects through the use random numbers generation. In the Janus simulation, for example, if all the factors are satisfied for a tank to fire at an enemy target, the final outcome is determined by a random number generation over a specific distribution of values. If the simulation is designed for a 80 percent kill rate (8 out of 10 probability) under the given circumstances, (again variables like distance, line-of-sight [LOS], terrain, etc. play a part in the number generation) a random number draw between 0 and 10 takes place which is compared to the number 8. If the randomly drawn number is less than or equal to 8, it designates a kill; A number greater than 8 is a miss. Because there is no way to predict the hits and misses each time, randomness occurs but in accordance with the designated 80 percent kill rate.

Like the example of a football team, which does not yield the same results every time a given play is run, a simulation of a battle does not yield the exact same results every time. The percentages of victories and defeats may remain the same, but variables such as target selection, rounds-fired to kill-ratio, and asset losses, etc. can vary in the simulated combat environment, as would be the case on the battlefield itself.

2. The Janus Database

For the user to best utilize the numerous assets of Janus for mission planning, it is important to understand the fundamental principles of the database. The Janus Database is a complex reservoir of detailed systems which form the heart of the simulation. Individual fighting systems have distinct properties such as, dimensions, weight, carrying capacity, speed, weapons, as well as weapons' capabilities like range, type of ordnance and ammunition basic load.[25] As with any simulation, a precise and comprehensive database is crucial to the operation of Janus.

Janus utilizes a hierarchical database with several layers of sections and sub-sections. A graphic depiction

[25] Department of the Army, Software User's Manual, Version 6.3, UNIX Model, Simulation, Training and Instrumentation Command (STRICOM)

of the database shows the depth and hierarchical relationships between its various portions (see Figure 4). The scope and depth of information contained in the Janus database is complex because it models in detail so many different aspects of the battlefield.

The database includes information on systems (soldiers, aircraft, tanks, ships, etc.), sensors (vision, radar, etc.) and weapons. Other information in the database include jammer characteristics, rotor acquisition times, heat stress, mine detection and characteristics.

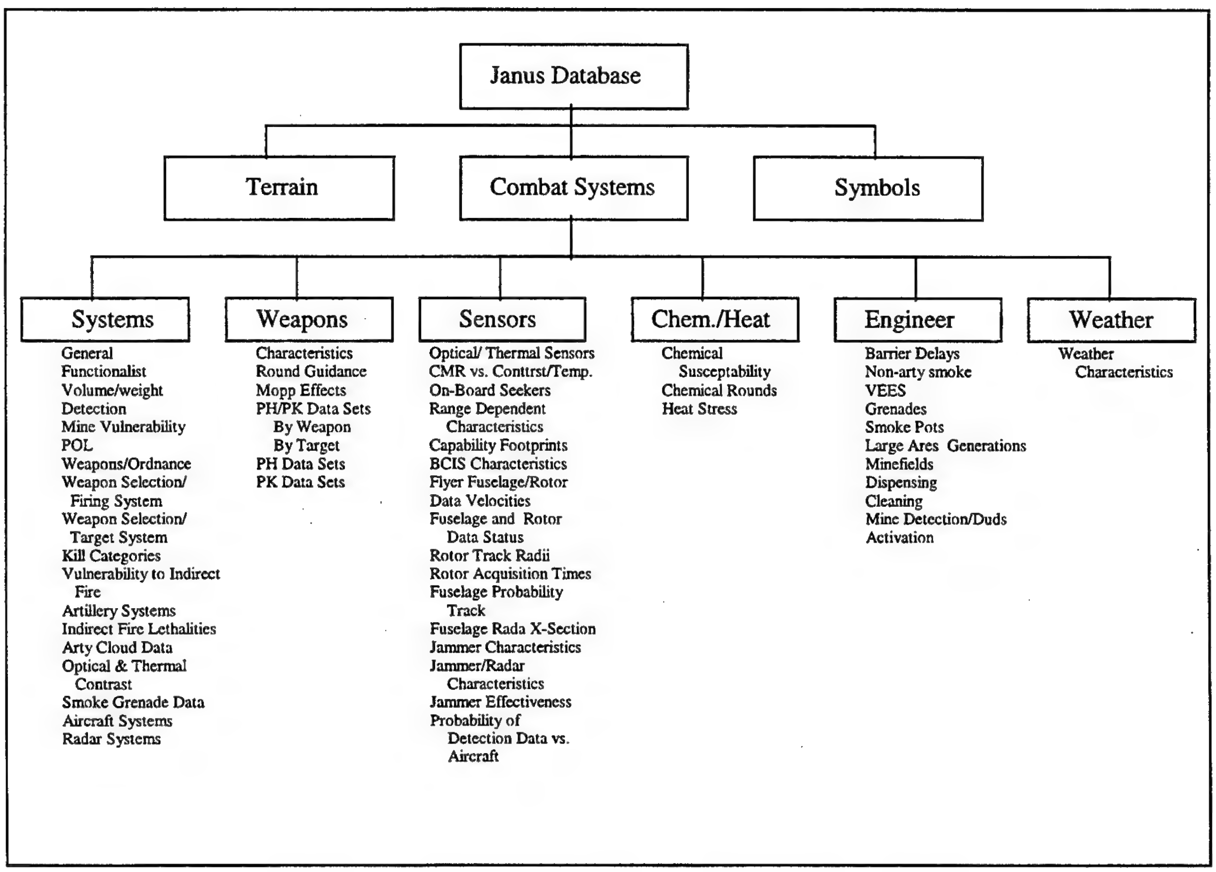

Figure 4: Janus Database Hierarchical Diagram

C. ADDITIONAL FEATURES OF JANUS

Janus has numerous features allowing the user to simplify intricate real-world scenarios. The following are a few of the basic aviation characteristics of the simulation model.[26] (For more attributes, See APPENDIX A: Janus Features.)

AVIATION SPECIFIC FEATURES

Planning Movement Routes - During initial planning, the planner can establish movement routes for units to follow during the execution phase of the simulation. These routes control the time and direction of unit movement. The user may set the movement so that the units move as soon as the simulation starts, or begin movement at a prearranged time, or begin moving in some assigned order. Movements are for ground and air movements (see Figure 5). A GO node appears as a triangle sitting on its base with one vortex pointing

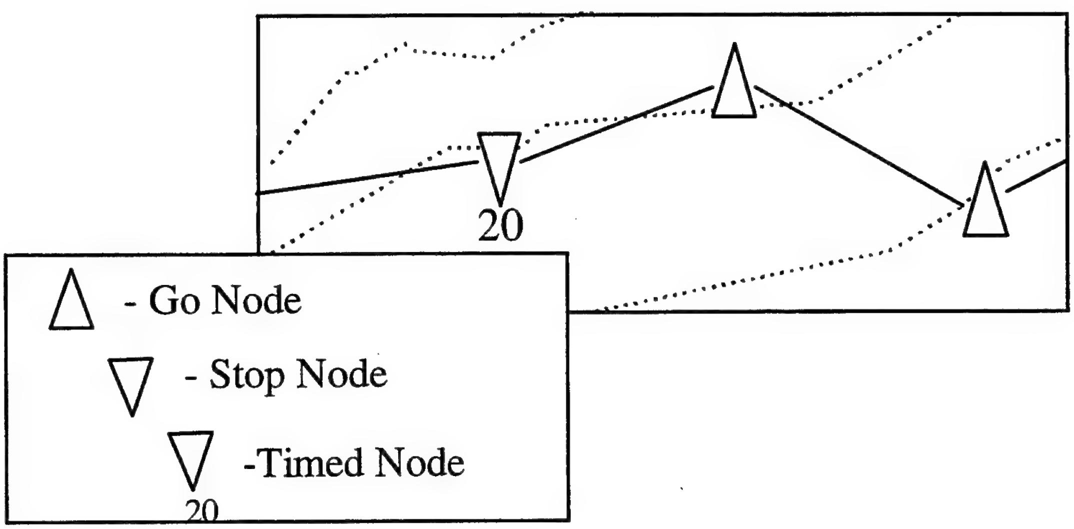

Figure 5: Movement Nodes

[26] Taken from data in *The Software Users Manual*, pp. 4-7. The list is not an inclusive list of Janus features but will give the reader a basic survey of aviation related capabilities.

up. A GO node usually signifies a change of direction. A STOP node, which is portrayed by an inverted triangle with its base up and tip down, halts a unit. The third movement node is a TIME node which appears as a STOP node with a number under it. A unit at a time node must wait for movement until the displayed time matches the time on the simulation clock.

Flight Mode - Each aircraft has two possible combinations of altitude and speed: low/slow; high/fast. Both altitude and speed depend on individual aircraft capability as described in the database.

Aircraft Pop up - Helicopters may fly to a prearranged defilade position, hover, "pop up" to engage targets, drop down to a hover, then pop up for another look. Helicopters can use terrain, buildings etc., to hide from enemy units. The helicopters can stay in the "pop up" mode only at STOP nodes and must move after firing.

Alarms - A radar alarm occurs when an air defense radar detects an aircraft. Three short beeps will sound, and a white line connecting the (unit) with a white symbol representing the detecting radar appears. The white symbol representing the detecting radar gives only an indication of direction and that the aircraft has been identified by radar. This symbol will recur as the aircraft continues to move, but is not the actual location of the radar battery. The radar site may launch an air defense missile at the aircraft after locking on. When that occurs, the aircraft will receive another warning just like the detection warning except that the connecting line is orange.

Low Fuel Warning - The user gets a low fuel warning when one of the systems reaches approximately one-eighth of its fuel capacity. A second and final warning occurs when the unit reaches one-sixteenth of its capacity.

D. SUMMARY

Combat Simulation can be a tool for mission planners. It is not a remedy for every problem a mission planner may face. It is not a crystal ball where the outcome of future

operations can be clearly seen. Nevertheless, it can provide a learning experience where, like an attentive and intuitive player at the Monopoly table, the user can explore viable options to assist planners in solving complex problems. Users must take "lessons learned" from the modeling process, scrutinize them, analyze their impact on mission objectives, and ascertain the impact of multiple forces affecting the tactical state.

With a heuristic application of combat modeling in mission planning, simulation modeling can expand the horizons of COA formulation. Simulation can be the basis for planning and act as a decision aid to stretch the ability of the commander to plan and employ forces.

IV. JOINT DOCTRINE AND SOF MISSION PLANNING

"War, like most things, is a science to be acquired and perfected by diligence, by perseverance, by time and by practice."
Alexander Hamilton

"All the numerous applications of physics, chemistry, engineering, etc. which make up the modern arsenal are in fact at the mercy of humans, the soldiers who use or direct them."
S.T. Das

A. INTRODUCTION

To effectively utilize combat simulation, it is important to understand the principles of SOF mission planning as outlined in joint doctrinal publications. Many factors may affect decisions made during the planning process such as time constraints, mission urgency, the availability of assets, and confidence in implementing simulation.

Using the previous chapters on modeling and simulation as a basis of understanding, this section concentrates on joint planning doctrine and the integration of ARSOA mission planning. While the implementation of simulation within the mission planning process is ultimately left to the discretion of the mission planner, this chapter provides the reader a basic understanding of when simulation can be

integrated into mission planning and it demonstrates the possible benefits accompanying the use of a simulation.

B. JOINT DOCTRINE AND SOF

Effective employment of SOF in pursuit of national security policy requires a clear understanding of **JOINT DOCTRINE**. The actions and directions SO utilize to implement Joint Doctrine are incorporated in **JOINT TACTICS**, **TECHNIQUES** and **PROCEDURES** (JTTP).[27]

A mission conducted under certain environmental constraints may require the employment of SO expertise and techniques. Should one of the characteristics change, the assignment may no longer fit the classification of SO. For example, the Grenada operation was designed to rescue a large number of American citizens and to publicly demonstrate U.S. resolve. As such, this required a large, visible conventional operation on a relatively large scale, with SO in support and targeted at specific objectives. On the other hand, had the goals been to recover a small number of detained personnel with limited U.S. presence, SO may have been selected as the preferred option. SO actions are not bound by any specific environment. They are described by

[27] Joint Pub 3-05, p. I-2.

the transitory characteristics and constraints placed upon a given mission.[28]

The employment of conventional forces normally involves movement of large occupational units demanding extensive support frameworks. SOF, however, are primarily a function of individual and small unit proficiency in a multitude of specialized, often unconventional combat skills exercised with improvisation, speed, innovation and self-reliance for short periods of time. (See APPENDIX B: Characteristics of Special Operations and Special Operations Forces.)

Special operators, utilizing tenets of joint doctrine, are an extremely viable alternative to the use of conventional forces. The small size, unusual qualities and self sufficient "packaged" capabilities of SOF offer the United States appropriate military responses that do not entail the degree of political liability, or possible risk of escalation, normally associated with the use of larger and more conspicuous conventional forces.

SOF was not meant to stand alone within the scope of conventional military operations. SOF is most often placed in a supportive role to conventional military leaders as was the case in Panama, Somalia, and Haiti. Thus SOF is not a

[28] Ibid., p. I-3.

substitute for conventional forces, but rather an asset to be correctly utilized and implemented in combination with conventional forces. Admiral William J. Crowe, Jr. stated:

> . . .first, break down the wall that has more or less come between special operations forces and the other parts of our military . . . second, educate the rest of the military; spread a recognition and an understanding of what you do, why you do it, and how important it is that you do it. Last, integrate your efforts into the full spectrum of our military capability.[29]

SO are usually joint, but may be conducted as a single-service operation. While a mission may be designated as a single-service operation, the support and coordination required most often involves other services' assistance, such as command-and-control structures and logistical assets.

The unifying effects of joint doctrine, coupled with the implementation of JTTP, allow for unsurpassed capabilities within the SOF community. Such unifying principles are essential for mission planners to plan joint operations successfully.

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[29] Statement by Admiral Crowe at the activation ceremony of the United States Special Operations Command (USSOCOM), 1 June 1987. From Joint Pub 3-05.3, p. I-1.

C. MISSION PLANNING

There are two basic types of mission planning which planners are, by doctrine, prepared to execute: deliberate planning and time-sensitive planning. These types will be discussed later on in this section. According to Joint Pub 3-05, regardless of the mission or operational environment, three principles of SO are extremely important:

> 1. **Specific targets or mission assignments for SOF should always contribute substantially to the strategic or campaign plan being executed.** Limited resources and the extensive planning required dictate that a commander selectively employ SOF for high priority operations. Further, the sensitivity of many SOF missions may force the NCA to place specific political, legal, time-of-day, geographic, or force size constraints upon employing and supporting the force.
>
> 2. **SOF missions are complete packages- insertion resupply, fire and maneuver support, extraction--(ARSOA is often critical in all these phases)--to be thoroughly planned before committing the force.** The nature of the target, enemy situation, and environmental characteristics of the operational area are key planning factors. They dictate the size and capabilities of the assigned force, the nature of tactical operations, methods of insertion and extraction, length force exposure, logistic requirements, and size and composition of the command and support structure. Although operational planning must focus on the objective, limiting intelligence and environmental information to the target area will not meet SOF requirements.
>
> 3. **SO can rarely be repeated if they at first fail, since SO targets normally are perishable either from a military or political viewpoint.** Therefore, thorough, detailed, and, whenever possible, repeated rehearsal is critical. These rehearsals should be conducted with the exact force to be committed and under the

same time and distance constraints in an environment whose terrain and weather conditions closely approximate the operational area. A by-product of such rehearsal is that the operational element absorbs alternative courses of action and is better able to adapt to changed circumstances during the mission. Commanders should recognize and plan for such preparation time.

1. Deliberate Planning

Deliberate planning is normally conducted during peacetime and refers to a hypothetical situation involving the deployment and employment of allocated forces and assets intended to be available. Such planning depends on analytical assumptions regarding the political and military situation that will exist when the plan is implemented.

National security policy is formulated by the NCA and conveyed through the Chairman of the Joint Chiefs of Staff (CJCS) guidance to the combatant commanders who build operational plans at the theater level. Most targets are designated by the component commanders and approved by the respective combatant commander to support the operational plan.

Operational plans and their MPAs are identified and kept current until mission execution or cancellation.
For instance, plans for operations in Haiti were continually reviewed, revised and "tweaked" based upon the evolving political, military and social environments in the country.

The final execution of the mission turned from a forced entry to the Cable News Network (CNN) meeting troops on the beach and at the airport of the country .

Deliberate targeting and mission planning can be applicable in a protracted crisis situation, such as the lengthy process leading up to operations in Somalia. Deliberate targeting and mission planning can apply in wartime as part of a theater campaign plan. This planning can be elucidated by Operation Overlord (which included lengthy mission planning and rehearsals by all assets involved, including Rangers) or made unilaterally against strategic or operational targets, such as the SO **SPECIAL RECONNAISANCE** (SR) and **DIRECT ACTION** (DA) missions in Operation Desert Storm, where SOF was tasked to locate SCUD missiles deep in Iraqi territory.

2. Time-Sensitive Planning

Time-sensitive mission planning refers to planning for the deployment and employment of designated forces and resources in response to an actual situation. This type of planning requires great flexibility and responsiveness. It demands the ability to meet changing situations with little time, possibly few resources, and only sketchy intelligence.

Contingency targeting and mission planning may be either deliberate or time-sensitive while crisis and combat mission planning are normally time-sensitive. Numerous small-scale operations (such as Operation Urgent Fury in Grenada, Operation Eagle Claw in Iran, and other NCA-directed operations) are representative of time-sensitive operations. In other instances (such as Operation Just Cause in Panama) sufficient time may be available to conduct deliberate targeting and mission planning.

Time-sensitive planning can be from the target or mission perspective, or both, (such as the recovery of downed aviators). A target may be classified as time-sensitive when it requires an immediate response because it poses, or will pose, a threat to friendly forces or it is a highly lucrative, fleeting target of opportunity. Such targets can include Intercontinental Ballistic Missiles (ICBM), or targets which may lose their value quickly (such as a bridge being used for an enemy advance or withdrawal).

A mission can be time-sensitive when there is a small window of opportunity during which the objective of the mission can be accomplished. An example of this would be taking out radar sites before an air strike (as occurred in Operation Desert Storm). The strikes cannot occur too

early because the radar could be fixed or repaired. On the other hand, if the attack on the sites is too late, friendly forces may be detected. Of critical interest today may be the SR of chemical and suspected nuclear facilities.

Employment of SOF assets against time-sensitive targets may be arduous. However, the very existence of SOF demands the ability to execute precision time-sensitive missions on short notice. No mission should be declared possible or impossible based primarily on time-sensitivity. Planners and commanders of operational units must weigh carefully and thoughtfully available resources and time against the probabilities of mission success and force survivability.

Exercises run at the NTC and JRTC follow specific time guidelines to rehearse time-sensitive planning. SO execution planning for time-sensitive missions normally requires a minimum of 96 hours for basic plan development (or possible clarification of a preexisting plan), detailed war gaming of variations to the basic plan, and preparation of the tactical force to execute the mission.[30] While modern mission planning aids, such as advanced computer technology or combat modeling, may assist planners in this phase, such assistance cannot replace human analysis.

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[30] See Joint Pub 3-05. 3, p. IV-4 and Joint Pub 3-05. 5 for detailed framework to ensure adequate execution planning.

D. TIME-SENSITIVE PLANNING CYCLE

The time-sensitive planning should begin at least 96 hours before mission execution. There may be situations where the urgency of the mission (hostage rescue, evacuation, etc.,) does not allow for the prescribed 96 hour time frame. The Joint Force Special Operations Component Commander (JFSOCC) may decide the situation does not permit normal execution planning. In such cases, component commanders must determine the minimum essential preparation needed to complete assigned tasks in the time allotted. Component commanders inform the JFSOCC if mission preparation time causes an unacceptable degree of risk of mission failure.

There are five phases prescribed in the time-sensitive planning cycle. These are:

Phase 1: Objectives and Guidance

Phase 2: Target Development

Phase 3: Weaponeering

Phase 4: Force Selection

Phase 5: Mission Planning

Specifics for time-sensitive planning, found in Joint Publication 3-05.5., are found in Appendices C and D: Time-

sensitive Planning Cycle and Targeting Diagram; and Time-Sensitive Mission Planning.

E. ARSOA MISSION PLANNING

Joint doctrine details SO mission planning as it applies to the actions of the COMSOC during theater-level planning, and to the oversight of detailed tactical actions assigned to subordinate SOF elements. The 3-05 Joint Publication series does not discuss tactical mission planning such as air route selection, application of specialized equipment, or specific contingencies on the objective. These dynamics are left to the specific services and the unit standard operating procedures (SOPs). The Joint Publications do identify, however, when tactical mission planning should occur.

Tactical mission planning, whether deliberate or time-sensitive, maintains mutual principals. Regardless of whether the MPA has only 96 hours to plan a time-sensitive mission during extended combat operations, or has months for deliberate mission planning where there is ample time to coordinate all facets of the mission (as was discussed in Operation Eagleclaw[31] and Operation Kingpin in Chapter V),

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[31] Operation Eagleclaw was the heroic yet tragic attempt to rescue hostages at the American Embassy in Tehran, Iran on April 23-24, 1980. The mission was aborted due to the loss of helicopters and a C-130 aircraft at a remote staging area, "Desert 1".

all planning should address courses of action (COA), rehearsals, as well as identify required forces. When time is not a luxury, SOPs play a crucial role in streamlining the planning process. Decentralized planning by subordinate commanders is essential. Based on the SOC commander's mission guidance, subordinate SOF commanders must autonomously conduct their own mission planning within the scope of joint doctrine, streamlined by unit SOPs.

ARSOA mission planning doctrine is found predominantly in the Tactical Standard Operating Procedures (TACSOP) at the battalion level, and in the Regimental Tactical Standard Operating Procedures (RTSOP) for the regiment. This inclusive document "delineates staff responsibilities and standardizes recurring operational and service support procedures for tactical deployment, execution of primary courses operational contingencies."[32]

As principally a supporting agency to SF, Rangers, and SEALs, ARSOA works closely with these supported assets by publishing the Regiment Mission Planning Guide (RMPG). The RMPG is designed to provide premission planning guidance to ARSOA's supported commands. It addresses capabilities, missions, planning parameters, etc. The RMPG document is not intended to replace the ARSOA mission planner, but rather

[32] From the commander's introduction to the 160th Special Operations Aviation Regiment (Airborne) Tactical Standard Operating Procedures (RTSOP).

augments the supported commands premission planning capabilities by detailing specifics which may assist them.

ARSOA planning sequences occur in one of three sequences which support joint doctrine: deliberate planning, abbreviated planning or crisis planning. The distinctions between the three are based on the time availabile for planning.

Deliberate planning is the method used when at home station, or at an Intermediate Support Base (ISB) with more than 24 hours available prior to mission execution. (Deliberate planning in joint doctrine prescribes a 96-hour cycle for planning). The ARSOA deliberate planning sequence is based on a 72 hour time schedule where no more than 1/3 of the planning time is available.

Abbreviated planning method is exercised when there is less than 24 hours available prior to mission execution. This type of planning follows the same basic method as the deliberate planning process but stresses rapid, concurrent mission analysis, staff estimates, and COA development. Again, staff planners are allotted no more than 1/3 of the available planning time.

Crisis planning is applied when immediate mission execution is required within 4 hours or less. This type of reactive planning underscores rapid "mental" mission analysis and preparation of verbal orders. The critical

node of this type of planning is decentralization - quickly conducting mission analysis at the battalion level and issuing orders to the Air Mission Commander (AMC) for detailed planning.

F. COA FORMULATION

This part of the thesis addresses planning with combat simulation, and looks at specific planing details coupled with how they can support ARSOA mission planning. This section leads into Chapter V where a historical case study is used to detail possible roles of combat simulation.

1. Tactical Decision Making Process

Generally, ARSOA uses a systematic Tactical Decision Making Process (TDMP) to carefully assess its mission, to develop COAs and to produce combat orders. The TDMP facilitates effective and timely mission analysis through application of professional knowledge, logic and judgment. Principles in FM 101-5 are used to enhance staff effectiveness in this inquiry.

TDMP basically consists of recognizing and defining problems associated with the mission. Brainstorming is essential in this phase of the mission since it precedes the analysis segment of the planning where combat simulation is

most essential. Facts must be gathered and valid assumptions explored to determine the scope of the problem. Based on the outcome of this exercise, solutions are developed and each solution analyzed. Each solution is carefully examined and the best resolution selected for utilization.

The combat simulation systems expert, along with intelligence analysts, begins to build the terrain data at this pahse of the planning process. Depending on specific information available, they can begin building the situation map. A detailed map study of the area of operation (AO) and specific target areas is detailed. When digitized terrain of the AO itself is used, (versus other terrain used which is similar to the AO), conjecture on line of sight capabilities is largely eliminated.

Databases for both enemy and friendly forces can be checked to verify system characteristics. For example, COAs dependent on specific enemy threat platforms together with their weapons' ranges and locations can be tested before and during COA development. This testing is demonstrated in Chapter V.

2. COA Analysis

ARSOA tactical planning staffs analyze COAs to determine strengths and weaknesses by using detailed war gaming. Staff and commander's war gaming follow a COA from start to finish to ascertain advantages and disadvantages as well as other considerations. This type of war gaming relies heavily on tactical judgment and experience. This step-by-step process focuses the planning staff and commander on each phase of the operation.

COAs which are suitable and feasible are compared with the use of a decision matrix. The decision matrix evaluates the COAs by use of the following criteria (which is sometimes weighted based on relative importance):

- **Risk**: Ability to accomplish the mission with the minimum required personnel and equipment.
- **Objective**: Focuses on the stated mission and accomplishes commander's intent.
- **Implicitness**: Clear, uncomplicated plan.
- **Flexibility**: Ability to retain freedom of maneuver.
- **Sustainability**: Ability to man, arm, fuel, fix and protect the force.

After the complete and thorough evaluation of all COAs,

staffs give the commander a decision brief and recommend a particular COA. The commander may accept the recommendation, modify it, or select another.

G. PLANNING WITH COMBAT SIMULATION

Use of combat simulation in both deliberate and time-sensitive mission planning presents a perplexing paradox. Deliberate planning, as described in joint documents, affords ample time for mission planners to utilize combat simulation to optimize COA analysis, route selection, and so forth. However, the greatest benefit may be using a simulation in time-sensitive planning. Granted, time is always limited. Yet the benefits of its unique applications, in the capable hands of those who understand its potential benefits, may help overcome time deficits and the frictions and fog of war (Clausewitz) which often accompany combat situations.

Chapter V is the link between the concept of combat modeling and its incorporation into ARSOA mission planning. It begins with simulation requirements, in the most generic sense, for planners to utilize modeling to its fullest extent. A brief discussion of combat modeling's application in an historical case study, the Son Tay Raid, will highlight simulation capabilities. This specific case study

was chosen because of its heavy rotary wing use, joint planning emphasis, and "elegant simplistic" plans formulation performed by NCA staff members all the way down to the raiding warriors.

The focus of Chapter V is on the application of combat simulation and crucial "what if"[33] sensitivity-type questions for actions on the objective.

[33] See John A. Battilega & Judith K. Grange, *The Military Applications of Modeling,* (Wright-Patterson Air Force Base, OH:Air Force Institute Technology Press, 1984) p. 8. "What if" questions can be used to explore the possible consequences of a wide variety of courses of action which are open to allies and adversaries; and they can be used to explore the implications of constraints imposed by physics, by tactics, by politics, or by resource limits.

V. COMBAT MODELING AND "OPERATION KINGPIN"

"[War] No other human activity is so continuously or universally bound up with chance"
Carl von Clausewitz
from *On War*

"From Plato to NATO, the history of command in war consists essentially of an endless quest for certainty- certainty about the state and intentions of the enemy's forces; certainty about the manifold factors that together constitute the environment in which war is fought…; and, last but definitely not least, certainty about the state, intentions, and activities of one's own forces."
Martin Van Creveld

A. INTRODUCTION

It does not matter how meticulous a plan is conceived, organized and implemented, there will always be a degree of uncertainty involved in the final outcome. Aircraft break, unexpected weather develops, threats do not behave as templated, communication falters and gaps in intelligence hinder thorough mission preparation and give rise to assumptions. Assumptions that are based on experience, knowledge and often pure intuition, can help fill intellectual holes in the planning process, but they may also give a totally false perspective. Such calculated risks and "chances" that ARSOA takes to support SOF hallmarks its willingness to adapt to the frictions of SO.

One of Carl von Clausewitz's consistent themes is that war is the province of chance, and chance offers up opportunities as well as presenting opposition. (An interesting note highlighting this Clausewitzian concept is the Chinese ideograph for "crisis" which is made up of two characters, one meaning "catastrophe or danger" and the other "opportunity".)[34]

The implementation of combat modeling can help fill the intellectual voids and fuzzy assumptions often found in SO planning. No SO mission has all the information necessary for planners to prepare completely with one hundred percent confidence. As you will see in the discussion of the Son Tay Raid, planners utilized the most sophisticated intelligence gathering technology available at the time and still had to assume away some concerns, like the existence of American POWs in the compound.

This chapter demonstrates the application of combat modeling in ARSOA mission planning by exploring the 1970 raid on the Son Tay POW camp located on the outskirts of Hanoi in North Vietnam. Planners had months to prepare, rehearse and execute the mission. Yet many questions went unanswered. Are there prisoners still remaining in the

[34] Elliot A. Cohen and John Gooch, *Military Misfortune, the Anatomy of Failure in War*, (New York: Vintage Books, 1991) p. 239.

camp? How many? Should an agent be infiltrated into the area to verify the existence of American servicemen?

Many variables are at play in such a high-stakes SO mission. Combat simulation can help streamline course of action (COA) selection and assist in war gaming actions on the objective. There are other uses which can be inferred, but for simplification and demonstrative purposes in this chapter, actions on the objective will be discussed in detail.

B. PRESUMPTIONS

Prior to applying combat modeling in a planning scenario, it is important to satisfy basic requirements before its employment by ARSOA mission planners or MPAs. The following prerequisites are assumed to exist for purposes of discussion in this chapter.

1. Database

The database must be complete, accurate, and detailed prior to mission planning. Emphasis must be placed on accurate systems, weapons and sensor characteristics prior to mission application. SO missions often employ unique systems depending on the situation. Time may not always be

available to manipulate the database during scenario analysis, especially during time-sensitive planning.

2. Systems Analyst/Combat Model Specialist

The key to successful implementation of combat modeling is the availability and employment of a systems specialist adept at understanding the mathematical algorithms, as well as the capabilities and intricate operation of the combat simulation. While it should be the commander's goal to train military planners and staff members to manage and apply the simulation, there are great long-term rewards in using a systems expert. Case in point: Janus does not model underwater SEAL operations realistically due to limited maritime parameters. A current study modeling the interaction of Navy SEALs and mine countermeasures had to be manipulated by the modeler/system specialist because Janus does not realistically represent underwater operations. So the modeler had to change the database in order for underwater swimmers to actually move one meter above the water. Despite the swimmers swimming one meter above water, the modeler adjusted the threat parameters so that the enemy above water could not see the frogmen. The underlying assumption was that the frogmen never broke the surface of

the water. Such management by systems experts can be utilized to overcome systems deficiencies and to allow for analytical creativity.[35]

System managers do posses manipulative powers, yet they must act as "honest brokers" and maintain realistic and undefiled databases. The database must remain free of over-inflated claims by those who feel certain weapon systems are not functioning properly or outcomes of sensitivity runs that are not according to their expectations.

3. Intelligence

Intelligence analysts play a major role in the tactical development of combat simulation scenarios. The more current and complete is the information available, the more valuable the evaluations will be. Without templating threat assets and their possible interaction with friendly forces, little information can be garnered from the scenario.

4. Terrain Files

Defense Mapping Agency (DMA) digitized terrain files, employed by Janus, must be readily available, especially in

[35] Current research being conducted by LCDR Bob Wilson on SEAL maritime mine operations at the Naval Postgraduate School, Monterey, California. Research to be published in 1997.

short-fuse, time-sensitive mission planning. Systems experts or responsible staff members must be proactive in preparing terrain data usable for planning. Preferably, the terrain should be loaded into the system. Similar terrain can be used in lieu of actual terrain, but this substitution impairs the analysis data.

5. Mission Types

ARSOA missions in support of DA, SR, and Counter Terrorism (CT) seem best suited for combat modeling. Other missions such as Foreign Internal Defense (FID) modeling are not yet developed enough for accurate and systematic validation.

C. PLANNING WITH COMBAT SIMULATION

In the following case, combat simulation could have been used in a multitude of areas. Air routes from the raiders' staging base in Thailand to Son Tay and return could have been modeled to determine route selection and effectiveness against the heavy North Vietnamese radar coverage. A commander's decision to attempt a mission may be influenced by the location of radar detection. The locations and time of engagements resulting in losses can

allow planners to evaluate whether risks are acceptable, and perhaps how to overcome the problematic areas and critical nodes of the mission.

Another combat simulation use could have been the selection of weapons, ranges, and most effective locations for the final assault. For example, beginning at the weapon's specific maximum range under the conditions representative of those at the actual time of the assault, the firing range can be decreased by appropriate increments and the respective effect on the probability of hit and kill recorded.

The combat simulation can only extrapolate those aspects it has been programmed to consider. Detailed replication in the database of the simulation of the actual terrain, vegetation, buildings, and so forth, must correspond with the actual terrain on the ground. If it does not, a planned firing position or landing zone may not be useful when the operational element arrives on the actual objective.

1. Repetitive Scenario Runs

To fully understand the probabilistic nature of warfare, more than one run of any given scenario is required. Multiple runs are required to determine recurrent

tendencies and to dismiss outlying anomalies. If it is agreed that battle is probabilistic and indeterminate factors will not repeat themselves exactly, then the need for multiple evaluations of a strategy is required. When intricate missions are planned and rehearsed, planners and participants conduct multiple rehearsals to determine and distinguish uncertainty in the mission. A single rehearsal cannot identify every problematic issue. The outcome in the first rehearsal run may be totally different from the fifth or tenth trials. Probabilistic combat simulation requires the same repetition.

2. Time Deliberation

Repetitive runs and scenario development demand time. Presupposing the systems analyst is knowledgeable of the simulation, that intelligence and order of battle (OB) are available for both friendly and enemy forces, a mission scenario development (like that of the following detailed Son Tay Raid) may take anywhere from 6-10 hours. This time includes loading the appropriate terrain files, building the systems (i.e. helicopters with appropriate weapons systems, ground components with associated personal weapons), insuring probability of hit (PH) and probability of kill (PK) data is properly applied, and the proper use of the

line of sight (LOS) and VIEW functions to tactically apply systems prudently within the context of the known intelligence. The more sides being modeled, the longer the simulation runs will take.

Rudimentary route applications in given scenarios can be applied in minutes if detailed turns, stops and timed stops are not required. Precise routes can be modeled in as little as 15 to 20 minutes. Timed indirect fires and artillery assaults can be constructed in about the same amount of time.

In the Son Tay scenario runs, the first two minutes were performed at real-time speed. This was to initiate the DISMOUNT application of the raiders and to put them in SPRINT mode. The final 26 minutes of each run was performed at 20 times the normal speed to allow for multiple runs. The faster speeds do not degrade the detailed analysis of the run.

The following scenario serves as an example of the link between combat simulation and ARSOA mission planning. Actions on the objective, the primary focus of most mission planning, will be the focus in this study.[36] The raiders in this SO had no room for error.

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[36] The data collected for this case study is in no way exhaustive but serves as an example of the capabilities of combat simulation.

D. THE SON TAY RAID

In 1968, over 350 American servicemen were held captive in North Vietnamese prisoner of war (POW) camps. By 1970, more than fourteen hundred servicemen were prisoners or missing in action (MIA) in Southeast Asia. One facility, Camp Hope, located 23 miles northwest of Hanoi, held fifty-five American POWs. In May 1970, U.S. intelligence sources discovered a coded message near this camp spelling out the total number of American captives and the location of a possible extraction site near the camp. Air Force Lt.Col. Larry Chesley (Ret.) was moved into Son Tay (Camp Hope) the day before Thanksgiving 1968. According to Lt.Col. Chesley, Son Tay was a wretched place to try to exist. It had bad water, was always wet "and just a miserable place to live."[37] He indicated that the POWs in Son Tay often would dry their laundry in the letters P.O.W. and other code letters.

American intelligence authorities immediately forwarded this information to general officers in charge of special operations at the Joint Chiefs of Staff (JCS) for operational consideration. On August 8, 1970, after careful deliberation, the JCS approved formation of a joint

[37] Personal interview with Lt.Col. (Ret.) Larry Chesley on October 31, 1996. Lt.Col. Chesley spent almost seven years in nine different POW camps in North Vietnam. He was shot down 16 April 1966 and was released 12 February 1973. Lt.Col. Chesley is the author of *Seven Years in Hanoi* (Salt lake City: Bookcraft, 1973)

contingency task force to begin to formulate plans to rescue the captive Americans believed to be held in Camp Hope. Operation Kingpin (the final name of the operation) had begun.

President Richard Nixon found himself in a political dilemma. Domestic forces, including families of servicemen held as POWs and those presumed MIA were playing into the hands of war protesters who opposed any involvement in Southeast Asia and Nixon's pro-involvement policies. Nixon wanted to end the war by finishing it with victory and honor. The possibility of snatching American POWs in North Vietnam proved tantalizing to Nixon; anything to relieve the pressure the American people were placing on him to end the war at almost any cost.

Nixon's pro-military stance supported the possibility of a rescue attempt. His military advisors did not have to perform a "hard sell." The new Chairman of the Joint Chiefs of Staff, Admiral Thomas H. Moorer, in his presentation to Nixon, later explained:

> I felt very strong that if we could get some of the POWs back home and let them circulate it would enable us to explain about the torture [and other abuse the POWs suffered]. The American people, who had been whipped up by the press, which was getting much of its information from Hanoi... would then have understood. This would have made it easier to eventually free the other POWs....

> What I was hoping for was what took place after the Christmas 1972 bombing of North Vietnam. The boys would have come home after Son Tay.[38]

Not only would the "boys" be freed, but the North Vietnamese would learn a hard lesson, leaving them uncertain and apprehensive about further U.S. action.

Admiral Moorer selected Brigadier General Leroy J. Manor, United States Air Force, commander of special operations forces at Eglin Air Force Base, to be the JTF commander. Colonel Arthur D. Simons was selected as his second in command, a United States Army 30-year professional and a veteran of three wars,[39] who was highly regarded as a special operator with a vast amount of experience in Vietnam.

Brigadier General Manor received clear and precise guidance from Moorer as to the direction he could take the task force: "You have the authority to put together a task force and train that task force."[40] Manor immediately assembled the best helicopter pilots he could find. Some were returned to Florida from Southeast Asia to participate

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[38]Lucien S. Vandenbroucke, *Perilous Options: Special Operations as a Instrument of U.S. Foreign Policy*, (New York: Oxford University Press, 1993) p.54.

[39] John G. Hubbell, *POW, A Definite History of the American Prisoner - of-War Experience in Vietnam*, 1964 -1973 (New York: Reader's Digest Press, 1976) p. 537.

[40]William H. McRaven, *Spec Ops, Case Studies in Special Operations Warfare: Theory and Practice* (Novato, CA: Presidio Press, 1995) p. 289.

in the operation. Colonel Simons personally recruited highly capable and experienced soldiers for the task force from the ranks of the John F. Kennedy Center for Special Warfare at Fort Bragg, North Carolina. Over 250 men eventually volunteered from which Simons personally chose 120 of them as the nucleus of the ground assault force. All but three of these men had already served a couple of tours in Vietnam. Once chosen, all the selected volunteers were taken to Duke Field (in the vicinity of Eglin Air Force Base, Florida) to begin training as a unit.

The training began on August 20 and ended on November 8, 1970. During this training period, regularly scheduled joint meetings were also held to plan the logistics and training activities. Intelligence continued to be funneled from Washington to the task force including photos of Son Tay and the proposed routes into and from the objective.

Intelligence and security proved to be key elements for keeping the element of surprise in the hands of the task force raiders. Because of the large quantities of information needed to insure some degree of success, other U.S. agencies like the Central Intelligence Agency (CIA), Defense Intelligence Agency (DIA) and National Security Agency (NSA), were basically co-opted to provide the required intelligence.

The task force was billeted in a cantonment area near Eglin AFB but isolated from the main base. The physical isolation of the unit proved essential in their "joint" training. None of the core operators knew what the mission would entail (the vast majority of the task force was briefed on November 18, 1970, two days prior to mission execution.)[41] Over 170 rehearsals were conducted during the next four months, many of which were full-dress rehearsals. The aviation rehearsals included more than 284 sorties and over 1000 total fight hours, mostly at night.

Every person, whether pilot or ground assault member, knew the duties of the other men. All outcome contingencies had been raised and analyzed countless times. Each participant fully understood the role he was to play and there was no room for anything but professional performance. Each participant was made fully aware of the goal of the mission. Lieutenant Colonel Elliot P. Sydnor, the Deputy Commander stated later, "the mission statement was clearly written to include the phrase 'To forcibly release and extract the prisoners.' I liked the word 'forcibly' as it provided a lot of flexibility in the use of force against the enemy."[42]

[41] MSGT McMullin (Ret.) counters Schemmer's assertion that the raiders became raucous when they found out where they were actually going (Schemmer, p. 159). In a personal interview McMullin stated that the raiders applauded when Simons claimed there would be no escape and evasion, that the raiders would stay and fight.
[42]Ibid., p. 329.

Brigadier General Manor, the JTF commander, had mission autonomy throughout all phases of the organizational buildup, training, and execution. He built redundancy into the mission execution phase so that the mission could proceed should any contingency arise (such as helicopter(s) malfunctioning). "Blue Plan," "Green Plan," and "Red Plan" were all rehearsed numerous times in case the need should arise. All the operators could switch to each plan without a moment's hesitation.

To overcome problems inherently associated when two different forces work together, Manor "emphasized the importance a of completely joint and unified approach to every facet of this complex operation." He later stated: "This was viewed as essential and was insisted upon throughout planning, training and employment."[43] Master Sergeant Kenneth E. McMullin (Ret.), a member of the assault force which "crash landed" into the Son Tay compound, emphasized the joint planning of the operation. "I was told one day to grab my assault gear and head to a waiting UH-1 helicopter. We took off and I thought that we would be going on another training ride."

MSG McMullin stated that the UH-1 slipped into formation with a C-130 aircraft, and the Army pilots then

[43]Vandenbroucke, pp. 60-61.

tried basically to hover inches above the C-130 while traveling faster than 100 knots in an attempt to see if the UH-1 could draft along with the massive transport aircraft! Despite numerous tries to explore the possibilities of using a UH-1 as the platform to assault the compound, an Air Force HH-3 helicopter was selected instead of the Army helicopter.[44] Such joint effort was the hallmark of this mission.

The execution of this elegantly simplistic plan (in a similar manner in which professional athletes make their occupations look simple to the average Sunday afternoon arm-chair-quarterback) was flawless. The helicopters in conjunction with the assault force performed remarkably well, interdicting overlapping radars which were known to be the most complex and dangerous in the world (see Figure 6). Aerial refueling went perfectly, as did the U.S. Naval air diversion over Hanoi which involved hundreds of aircraft launched from two diversionary aircraft carrier groups.

As the helicopter assault force, led by an Air Force C-130, closed on Son Tay, one HH-53 helicopter carrying Simons' support element mistakenly landed 400 meters south of its "planned" objective, while the lead HH-53 helicopter brought down the two guard towers in the compound with a

[44]Personal interview with MSG Kenneth E. McMullin (Ret.) on 24 July 1996.

stream of mini-gun fire. The HH-3, with the 14-man assault element, crashed into the compound with a layer of mattresses on the floor to cushion the impact. The support element landed safely to the south of the compound (see Figure 7).

The compound Simons' support element mistakenly assaulted, that looked similar to the Son Tay camp, housed a group of non-Vietnamese advisors and support personnel. "Green Plan" (loss of one helicopter) was immediately put into effect when the security group leader realized Simons was not there. After the helicopter returned 9 minutes later to pick up the support force, Simons' 22-man assault element had liquidated the inhabitants of the mistaken objective[45], they returned to the Son Tay compound where the remainder of the force found there were no prisoners to be rescued. They were moved to other camps months earlier.

Within 26 minutes of arrival, the entire force had reassembled, and departed with only one minor injury. Despite heavy surface to air missile (SAM) threats, the entire raiding force safely returned to their staging base in Thailand. Two days later, the task force returned to the United States and was disbanded.

[45] Benjamin F. Schemmer in *The Raid* claims that Bull Simons' 22 men killed between 100 and 200 of these soldiers. Simons' men noted that these men were much taller than most Orientals, between "5 feet 10 inches to 6 feet Orientals tall, not wearing the normal NVA dress, but instead T-shirts and fitted dark undershorts." P. 171.

E. APPLICATION OF COMBAT SIMULATION

There are a myriad of variables which planners could look at when analyzing any operation. Since the fundamental element of surprise was so critical to mission success, let us look at the possible outcomes had the element of surprise been taken from the raiders when assaulting the objective. Surprise was such an essential part of the operational plan, it gave the required "relative superiority"[46] that was crucial to the success of the raiders.

Mission planners staged the assault on the compound to happen between guard shift rotations. Without the element of surprise, many of the POWs probably would not have survived. What happens if the raiders had attacked without surprise? The following illustrative scenarios are possible. Planners could explore these scenarios when analyzing courses of action (COAs) to be taken on the objective.

A cursory description is given for each of the scenarios together with the assumptions made for the mini-study. There will be at least five simulation runs conducted for each scenario. In the data tables, each

[46] McRaven in *Spec Ops* describes relative superiority as "a condition that exists when an attacking force, generally smaller, gains a decisive advantage over a larger well-defended enemy," p. 4.

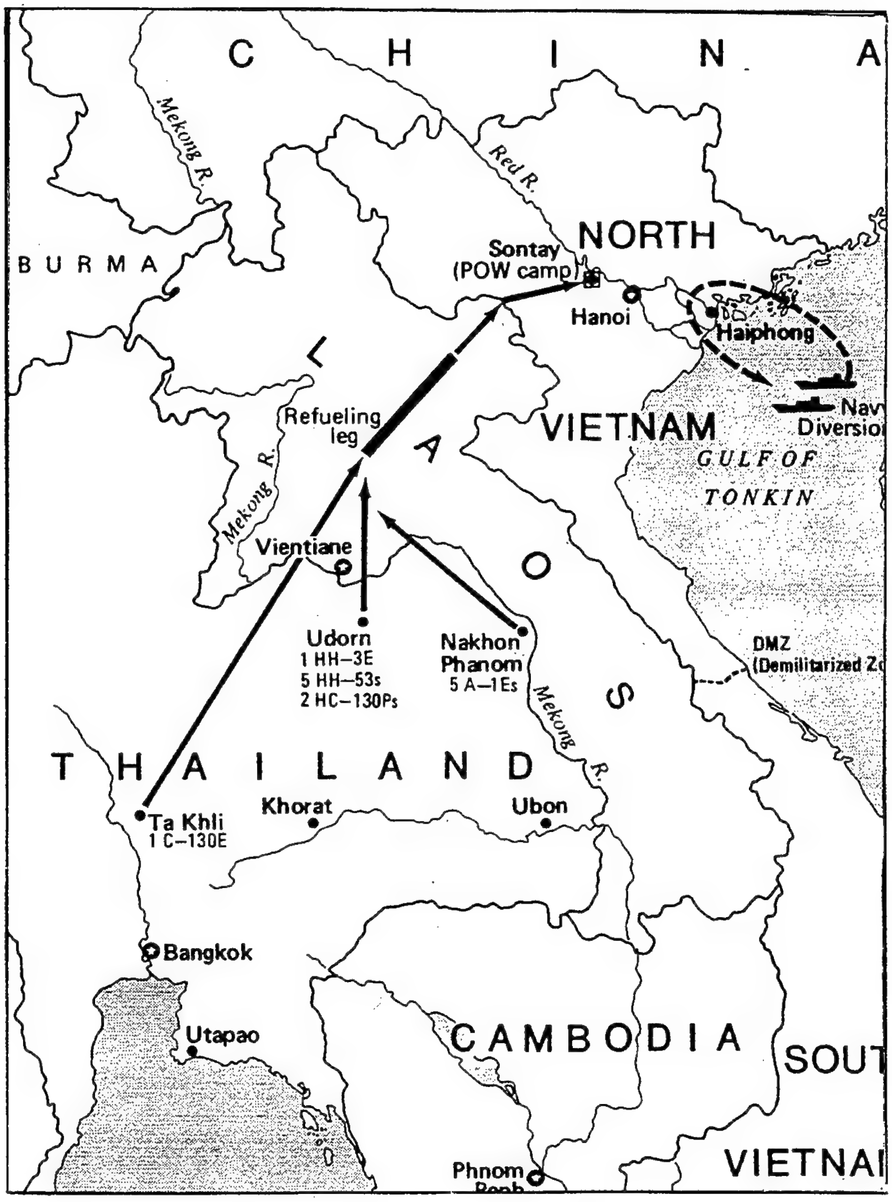

Figure 6: Route of the Son Tay Raid Force
(From Vandenbroucke, *Perilous Options*)

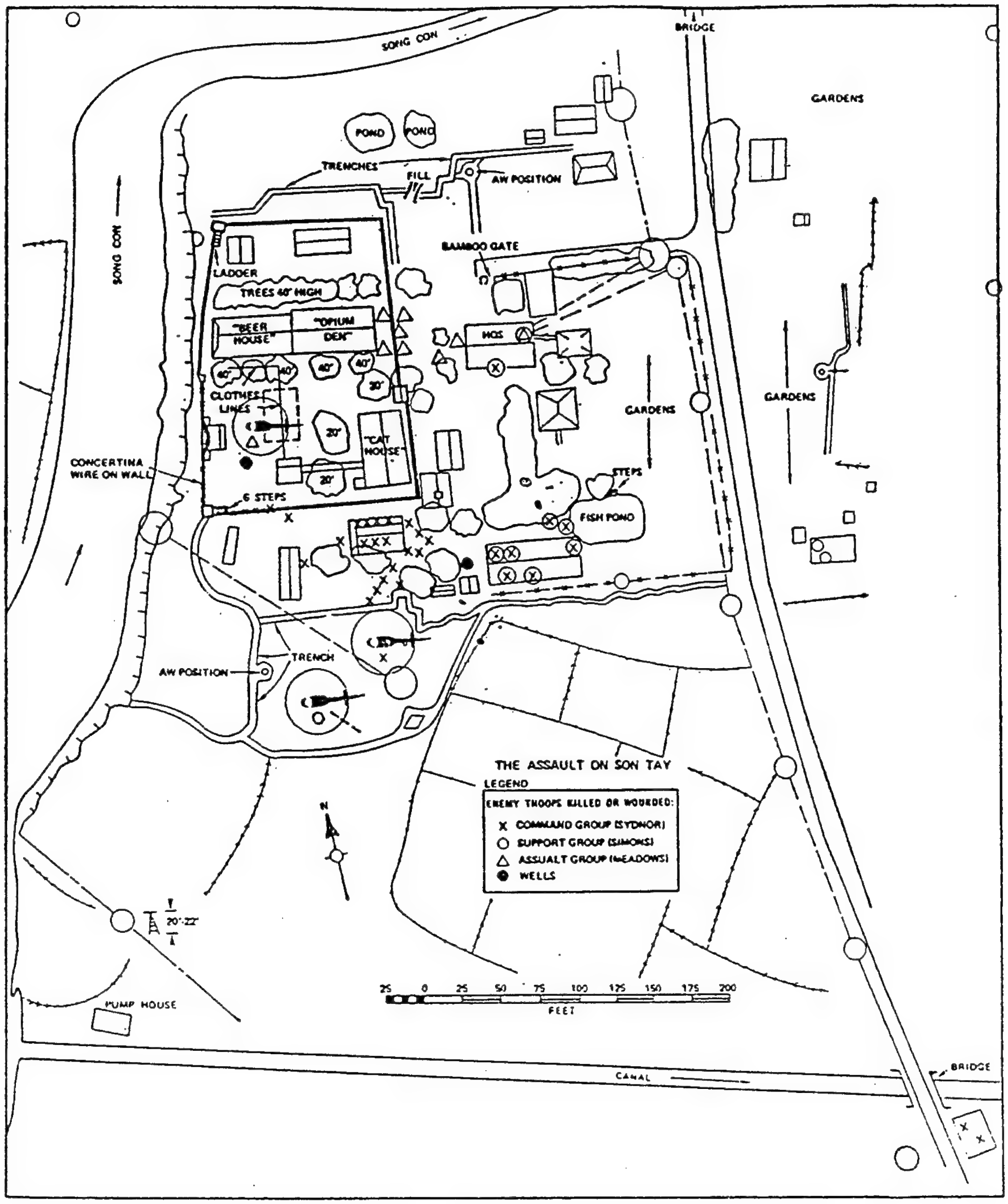

Figure 7: Son Tay Compound

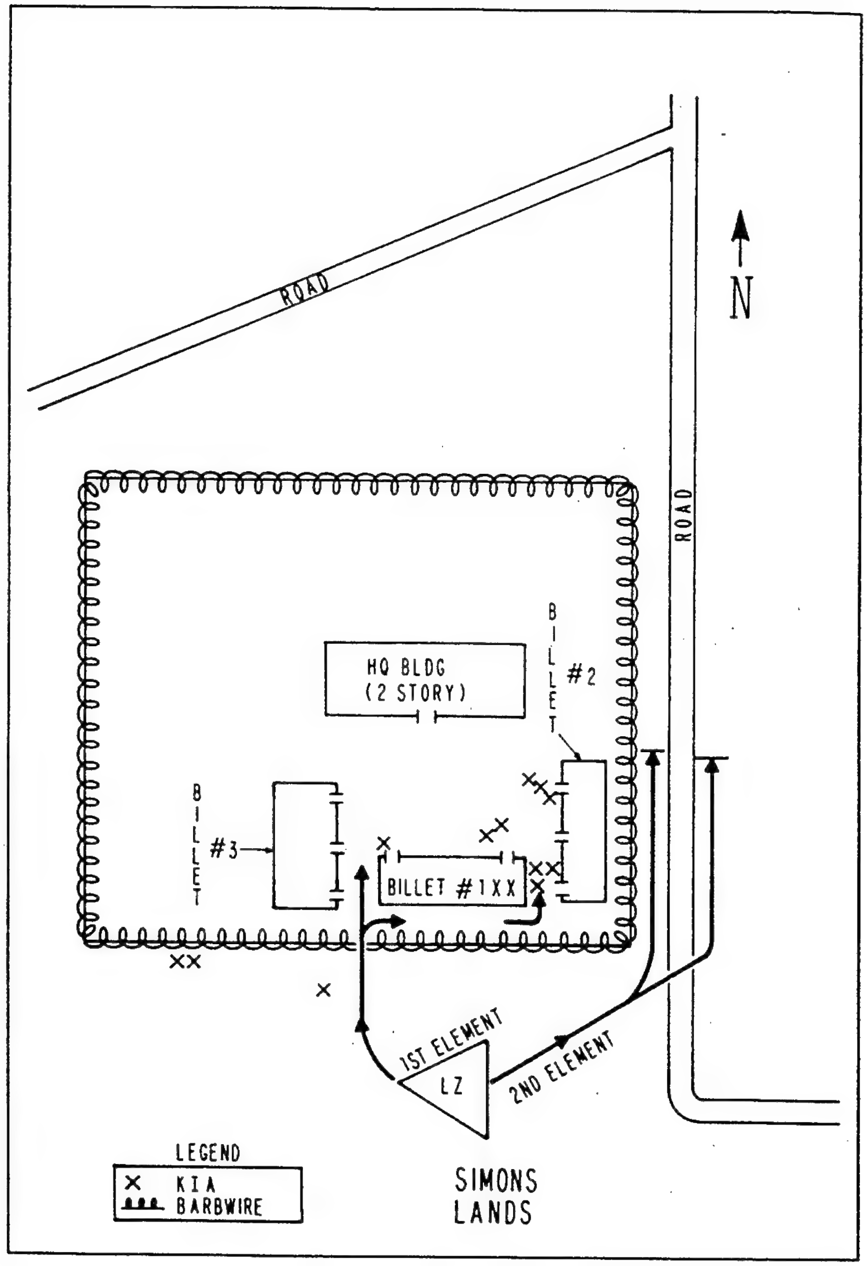

Figure 8: Secondary School Overhead View (From JCS)

scenario run will be analyzed according to the loss of both friendly and enemy forces, or assault helicopters. Conclusions based on an analysis of the basic findings are then presented. These "discoveries" can be the basis for further investigations.

1. Scenario "1" - Entire Assault Force

In this mini-study, the 56-man raiding force assaults the compound and does not split its force into a blocking element to cover the southern avenues of approach.

ASSUMPTIONS:

1. The raiding force does not have the element of surprise. The North Vietnamese Army (NVA) guard force numbers 44 men who are armed with small arms, and who are alert, attentive and well prepared.

2. All U.S. aircraft infiltrate and exfiltrate without incident.

3. The secondary school to the south is not occupied.

Five runs were made of this scenario, resulting in the following data:

RUN	Enemy Losses (Total of 44 NVA)	Percent loss	Raider Losses (Total of 56 Raiders)	Percent loss
Run 1	30	68%	2	4%
Run 2	23	52%	3	5%
Run 3	31	70%	9	16%
Run 4	34	77%	13	23%
Run 5	32	73%	9	16%

Conclusions: Friendly losses appear to be "acceptable" within the context of such a dangerous mission. In this scenario, the lack of surprise appears to be overcome by the lethality of the full force on the compound.

In the next scenario we consider how the outcome of the mission might have been affected if a blocking force had split the raiders' firepower by taking up blocking positions to the south.

2. Scenario "2" - Split Assault Force

In this mini-study, a 22-man blocking force must cross open fields to assume blocking positions approximately 200 meters to the south.

ASSUMPTIONS:

1. The raiders do not have the element of surprise.

2. All aircraft infiltrate and exfiltrate without incident.

3. The secondary school to the south does not pose a threat.

Five runs were made of this scenario resulting in the following data:

RUN	Enemy Losses (Total of 44 NVA)	Percent loss	Raider Losses (Total of 56 Raiders)	Percent loss
Run 1	22	50%	22	39%
Run 2	18	41%	14	25%
Run 3	18	41%	28	50%
Run 4	20	45%	28	50%
Run 5	22	50	35	63%

Conclusions: The apparent splitting of the assault forces proves to be devastating to the raiders. Since the blocking element (22 men from Simons' support group) must cross over open fields to get to their positions after dismounting from the aircraft, they come under heavy small arms fire. This requires the blocking force to disengage to assume their planned positions. Consequently, raider

losses are much heavier and the enemy losses are much lighter. This is consistent with a "divide-and-conquer" paradigm.

3. Scenario "3" - Secondary School Clash

In this scenario, the raiding force assaults the compound, and the blocking force assumes its planned positions (approximately 200 meters to the south) but must now contend with 100 NVA located at the secondary school. These NVA[47] are alerted when the first helicopter flies over their compound which it has mistaken for Son Tay. About six minutes after the fly over, the first NVA elements of the secondary school head up the road with small arms to assist the NVA at Son Tay (approximately 400 meters to the north). Simons' blocking group confronts the secondary school elements.

ASSUMPTIONS:

1. The raiders do not have the element of surprise.

2. All aircraft infiltrate and exfiltrate without incident.

3. The secondary school to the south does poses a threat.

[47] The acronym "NVA" is used for lack of a better term. There is no open source documentation as to their definitive identity.

Eight runs were made of this scenario resulting in the following data:

RUN	Enemy Losses (Total of 144 NVA)	Percent loss	Raider Losses (Total of 56 Raiders)	Percent loss
Run 1	19	13%	56	100%
Run 2	32	22%	53	95%
Run 3	69	48%	43	77%
Run 4	50	35%	30	54%
Run 5	61	42%	41	73%
Run 6	65	45%	37	66%
Run 7	47	33%	47	84%
Run 8	34	24%	41	73%

Conclusions: Despite the blocking force being in position to confront the threat from the south, the apparent combination of disbursing the assault force on the objective coupled with having to fight the 100-man NVA relief force from the south, proves devastating in casualties among the raiders. The NVA losses averaged from the eight runs totaled 33% while the 78% average raider losses were catastrophic.

4. Scenario "4" - Aircraft Losses

Scenario Four is the same as Scenario Three except the aircraft are susceptible to enemy small arms fire (machine gun and AK-47).

ASSUMPTIONS:

1. The raiders do not have the element of surprise.

2. All aircraft infiltrations and exfiltrations are susceptible to small arms fire.

3. The secondary school to the south poses a threat.

Fifteen runs were made of this scenario (because of its complexity), resulting in the following data:

RUN	Aircraft Losses HH3/HH53	Enemy losses (144 Total)	Percent losses	Raider losses (56 Total)	Percent losses
Run 1	1-HH3	82	57%	52	93%
Run 2	0	97	67%	39	70%
Run 3	2-HH53	76	53%	42	75%
Run 4	1-HH3	83	58%	44	78%
Run 5	1-HH53	68	47%	51	91%
Run 6	2-HH53	72	50%	46	82%
Run 7	0	73	51%	42	75%
Run 8	0	63	44%	46	82%
Run 9	0	100	69%	45	80%
Run 10	1-HH3	81	56%	46	82%
Run 11	1-HH3&HH53	66	46%	49	87%
Run 12	1-HH3	69	48%	41	73%
Run 13	0	73	51%	48	86%
Run 14	1-HH3	66	46%	38	68%
Run 15	0	72	50%	38	68%

Conclusions: According to this analysis, .08 percent aircraft losses can be expected along with 2.4 crew members. The NVA lost 76 men on the average or about 53%. Raider attrition averaged 44 men or 79% of the ground force.

In the next two scenarios, commanders and planners are concerned with the survivability of aircraft if they should encounter weapons fire other than from the expected small arms. In Scenario Five, An RPG gunner with another enemy soldier equipped with an AK-47 are in two separate towers.

Planners also wonder during this investigation, what might occur if the RPG/AK-47 teams are hidden.

5. Scenario "5" - Aircraft vs. RPG Teams in Towers

In this scenario, planners want to see the impact of RPGs on the assault helicopters. Two RPG teams, each with an AK-47 gunner, are situated in 10-meter towers in the compound. The towers overlook a bridge to the north and a road intersection to the south.

Assumptions:

1. The enemy RPG/AK-47 teams are alert but do not anticipate an air threat. Thus surprise is on the side of the approaching helicopters.

2. The aircraft are susceptible to the RPGs and small arms fire. The air crews are poised to interdict the RPG/AK-47 teams.

3. There is no threat from the secondary school forces to the south.

In this scenario, five runs were made of the scenario resulting in the following data:

RUN	Aircraft Fatalities (1 HH3/3 HH53)	Fatalities RPG/AK-47 Teams (2) (1 RPG/1 AK-47) EA.
Run 1	0	2 RPGs, 1 AK-47
Run 2	0	2 RPGs, 1 AK-47
Run 3	0	1 RPGs, 1 AK-47
Run 4	0	2 RPGs
Run 5	0	2 RPGs, 1 AK-47

Conclusions: The aircraft were poised to take out the towers and may have been prepared for the possibility of weapons other than small arms. As the aircraft approached the compound from the south, they were searching for, and ready to engage, any threat. On the other hand, the NVA teams in the towers were slower to react due to their wide and slow search patterns: they were not expecting aircraft to fly into and near the compound.

Next let's see what happens if the teams were not in the towers as expected by the raiding force. How would this then affect aircraft infiltrations and exfiltrations?

6. Scenario "6" - Aircraft vs. Hidden RPG Teams

In this final demonstrative scenario, the RPG/AK-47 teams are placed in the compound with very low profiles. Aircraft are nearly on top of them prior to recognizing their existence.

ASSUMPTIONS:

1. Surprise is on the side of the raiders.

2. The aircraft are susceptible to the RPGs and small arms fire.

3. The air crews are poised to interdict the RPG/AK-47 teams.

4. There is no threat from the secondary school forces to the south.

Five runs were made of this scenario, resulting in the following data:

RUN	Aircraft Fatalities (1 HH3/3 HH53)	Fatalities RPG/AK-47 Teams (2) (1 RPG/1 AK-47) EA.
Run 1	Lead HH53 killed	1 AK-47
Run 2	Trail HH53 killed	1 AK-47
Run 3	HH3 killed	1 RPGs, 2 AK-47
Run 4	HH3 killed	1 RPG
Run 5	HH3 killed	1 RPG

Conclusions: The aircraft had a difficult time detecting and acquiring the RPGs in the compound. By the time the aircraft sensors did acquire them, the aircraft were on top of their positions.

F. SUMMARY

These scenarios provide illustrative examples of the potential uses of combat simulation in planning, allowing planners to see the effects of changing many variables. In the actual Son Tay raid the secondary school (located about 400 meters to the south) was assumed not to be a threat to the assaulting force. In retrospect, it was extremely fortuitous for the raiders that Simons accidentally landed at and liquidated the threat in the compound. From our study in Scenario Four, had the forces housed there been allowed to become factors in the fighting at the Son Tay POW

compound, the outcome could have been totally different (and even disasterous to the raiders)

How different the outcome may have been if surprise had been sacrificed and had not been a beneficial tool for the raiders. Without the element of surprise, as exemplified in the scenarios, the tactically successful mission (successful infiltration, exfiltration, minor injury to one raider and safe return to staging base of the entire assault force) could have been another dismal POW rescue failure with the distinct possibility of adding "raiders" to the growing number of captured POWs in North Vietnam.[48] The outcome of the mission could have been totally different had RPGs been in the compound (as seen in Scenario Six). The raiders were prepared to take the towers out, but if the RPG teams had been hidden, the aircraft would have been extremely vulnerable and the outcome of the mission could be altered.

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[48] The Son Tay rescue was **not** the first POW rescue attempt in Southeast Asia. It was actually the 71st "dry hole". In South Vietnam, Cambodia and Laos, 91 such rescue attempts were mounted between 1966 and 1970. At least 45 to 50 of them were triggered by reports of U.S. POWs. Seventy-nine of the operations involved outright "raids". Of the 91 rescue operations, 20 succeeded in rescuing 318 South Vietnamese soldiers and civilians. But, of the 45 raids mounted to rescue American POWs, only one succeeded. Army Specialist Fourth Class Larry D. Aiken was rescued on July 10, 1969, from a Viet Cong POW camp, but he died in an American hospital 15 days later from wounds inflicted by his captors just before his rescue. The raid, had apparently been compromised at the last minute.

Lt.Col. Chesley stated that despite the failure to rescue them, the attempt was the best thing anyone could have done for them. "It got us all together for the first time."

A prudent and judicious mix of combat simulation and human ingenuity can lead to discovery of the critical nodes in the execution of the mission. The heuristic application of combat modeling can allow commanders and staffs another method for learning possible outcomes through exploration. In this method or process, the answers to the obvious questions may not be as valuable as discovering unobtrusive, yet critical, questions requiring answers.

VI. FUTURE OF SOF MODELING RECOMMENDATIONS AND CONCLUSIONS

"All in all, the emerging world is likely to lack the clarity and stability of the cold war and to be a more junglelike world of multiple dangers, hidden traps, unpleasant surprises and moral ambiguities."
Samuel P. Huntington

The Greek poet Homer mused that the quest or the journey is the all-important goal in life, not mere arrival at the destination. Clausewitz's search lead him to continually search for answers to the question, "How can we analyze war?"[49] The pursuit continues today as special operations commanders, staffs, and planners strive to understand the critical variables which can curtail the success of the best planned special operations missions. The preceding chapter illustrated how combat simulation can be used in mission planning to explore variables affecting actions on the objective and weapon system's affects on aircraft performance. There are even more roles that combat simulation can fill within the SOF community.

The following is a discussion of additional roles which combat simulation can play in the SOF arena. We also discuss some USSOCOM models used now and under future cosideration. Recommendations and conclusions then follow.

[49] See Peter Paret, "Clausewitz", *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, (Princeton, NJ:Princeton University Press) pp. 186-213.

A. ADDITIONAL COMBAT SIMULATION ROLES

1. Historical Case Library

Imagine a staff having access to a library of SO missions to be used for analysis as they prepare for future operations.[50] For example, The Son Tay Raid could have been used as a tool for planners in preparation for the rescue attempt of the hostages in Iran in 1980. Contrasting and comparing aspects of the actual mission could enlighten and allow planners to visually war game the mission. Details can be changed such as decreasing or adding personnel, platforms or weapons systems to gauge the outcome of the mission or affects on enemy forces.

The USSOCOM J-5C modeled scenarios of the Task Force Ranger mission in Mogadishu and the SEAL mission at Patilla. Specific parameters of the model were altered to create historically accurate depictions. Such qualitative historical documentaries allow commanders, staffs, and planners to replay continually the operations and to perform examination as needed.

[50]From discussions with Professor Gordon McCormick, Academic Advisor for the Special Operations/Low Intensity Conflict (SOLIC) curriculum at the Naval Postgraduate School, Monterey, California.

2. Electronic Sand Table

Mission planners need to know, see, and understand the disposition of all friendly and enemy forces in the AO prior to mission planning. This situation map is used continually to deconflict air and ground routes, and to select COAs. It must be updated continually to maintain current order of battle. This is a time consuming task which invariably falls to the S-2 Intelligence Officer to insure the overlays are current, legible and precise.

A high resolution combat simulation, such as Janus or the Joint Tactical Simulation (to be discussed later in this chapter), can take the place of the conventional situation map and overlays. Once the terrain file is loaded, all available information on friendly and enemy forces can be pulled from the database (maintained by a systems manager) and placed into a scenario file. Forces and equipment are identified by appropriate icons which can be easily modified to suit the needs of the user. This type of use is simple and falls within the "set-up" parameters of systems experts mission planners. The benefits can be substantial.[51]

The terrain graphics offer an extremely perceptible and up-to-date version of the area of operation. The area to be analyzed is at the discretion of the user. The resolution

[51] See Hakala, p. 47.

or detail, required by the user can be changed easily. The versatility of terrain analysis is remarkable.

Sensor and detection capabilities can be "played" out to determine minimum and maximum visual ranges of personnel and platforms.

3. After Action Tool

After Action Reviews (AAR) play an important part in the ARSOA planning and learning process. Lessons learned from each mission are invaluable for follow-on missions. The use of high resolution modeling allows debriefers to systematically (and visually) progress through all stages of mission execution: from the staging area, to air movement, to execution of actions at the objective and exfiltration, and return to the staging area. The actual mission actions can then be compared to those that were preplanned. Validation of the model can also occur when actual results of the mission are compared to predictions of the combat model. Post mission discussion can lead to additional COA analysis and effectiveness.

4. War Gaming Tool

An advantage of war gaming, compared to field exercises, is that it makes people think about war, without

the risk of losing lives or equipment. Using combat simulation with its inherent capability to replay scenarios repeatedly without expending vast amounts of time, resources or energy can benefit ARSOA. During war gaming, time can be compressed, stopped, or expanded to allow concentration on critical nodes of concern or interest. War gaming through combat simulations can be played almost anywhere. Computer-assisted war gaming can minimize exhaustive calculations and allow the players to focus on effects of specific decisions.

Combat simulation war gaming can be extremely objective if data bases are unbiased. The capabilities of specific enemy threat, for example, cannot be degraded by opposing players to better affect the desired outcome. War gamers must work within the honest and impartial parameters established by the honest broker; namely, the database manager.

The emphasis of war gaming is on human interaction. It can be an extremely powerful learning tool. However, there are drawbacks to simulations. Lessons learned in war gaming will never take the place of actual combat experience. Admiral Arleigh A. Burke stated "nobody can actually duplicate the strain that a commander is under in making a

decision in combat."[52] War gaming is not perfect, but it can "teach us what we didn't know, we didn't know."[53]

5. Mission Preview

Tactical mission planners are often the same as those leading operational missions. Such planners become intimate with the details and fine points of the mission. As planners and operators perform mission planning using combat simulation, combat planning becomes a mission preview exercise, allowing crews to preview mission execution prior to rehearsals or execution.

Mission planning with combat simulation is an extremely fluid and logical process, with each element overlapping in chronological importance. Because the planner can see the scope of the plan and the critical junctions which may affect the outcome, he can focus on the critical portions of the mission during rehearsals. Like the Son Tay raider air crews who logged 1000 flight hours, 268 training sorties and rehearsed 170 times, the execution of the mission can become almost an extension of rehearsals (see Figure 9).

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[52] Perla, *Wargaming and its Uses*, p. 250.
[53] Ibid., p. 284.

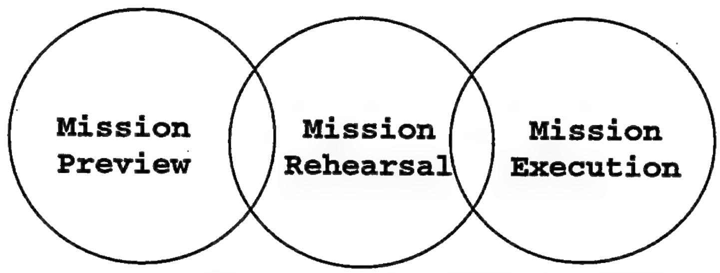

Figure 9: Mission Preview, Rehearsal, Execution Interrelationships

There may be instances where time-sensitive mission planning does not afford the time to rehearse. Previewing the mission utilizing high resolution combat simulation can allow planners and operators some degree of premission visualization, war gaming and analysis.

6. Order of Battle Database

The database on a high resolution simulation allows multiple data entries for every piece of equipment, whether friendly or enemy. Rather than referring to manuals on enemy equipment or weapons systems to find attributes relevant to mission planning, a simulation database can be used to store and file information in a categorized and easily accessible method. Also, weapon and sensor range capabilities can be visually depicted with a click of the mouse button rather than swinging arcs on a topographical situation map. The impact of terrain features is precisely calculated, not guessed. The process of developing such a

database may be time consuming, but the result would be a valuable mission planning tool.[54]

B. CURRENT USSOCOM MODELS

Combat simulation presently utilized at USSOCOM is the Joint Tactical Simulation (JTS). It was originally developed jointly by the U.S. Air Force and U.S. Army combining USAREUR's Urban Combat Computer Assisted Training System (UCCATS) and the U.S. Air Force's Security Exercise Evaluation System (SEES) into a single program.[55]

JTS provides SOF the capability to model explicitly SOF activities at a high resolution level. The primary focus is at the battalion level and below in conventional and unconventional urban warfare operations. The high resolution makes it a well-suited team/element training, especially in DA and Counter Terrorism (CT) missions.

The JTS simulation can model ten sides simultaneously including civilians, refugees, terrorists, and partisan forces along with SOF. This ability alone makes it ideal for modeling complex SOF operations where numerous factions (such as were found in Somalia) have an impact on almost any operation. Multinational operations in Bosnia is yet another example of its potential viability.

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[54] Hakala, p. 48.
[55] *Special Operations Forces Simulations Catalogue,* June 1995.

The high resolution of JTS makes it suitable for team/element training and planning, specially in DA and CT. Unlike the model used in this thesis, JTS is capable of modeling operators at various speeds (such as crawling, walking or running) as well as depicting stationary subjects either standing, crouching, or prone.

In JTS, urban warfare is extremely realistic. This is not so surprising given that the conception and birth of JTS was a result of the need to model urban warfare in Europe. JTS allows simulation of combat in breaching of, and infiltration into, buildings and allows for vehicles to enter buildings. It can also model air assets from take-off to landing with multiple speed and altitude variations.

Another high resolution model, the Joint Conflict Model (JCM), which was developed as a part of the Pacific Command's Joint Training Forces Simulation System (JTFSS), is used as an exercise driver for training of Joint Task Force commanders and staffs. This simulation can model up to five sides (as compared to ten with JTS and six with Janus 6.0), and it models both conventional and unconventional warfare as well as special operations. It also emphasizes amphibious and littoral operations.

The JCM system possesses the capability for modeling SOF missions. High levels of resolution allows very detailed analysis down to the team/element level. It can

possibly be used as a staff trainer for JSOTF to SOCCE. This model provides a diverse range of modeling possibilities, including civil affairs (CA) and FID.

The Joint Conflict and Tactical Simulation (JCATS) is a merger of both JTS and JCM capabilities. It is scheduled for release in the Fall of 1997.

C. MISSION PLANNING MODELS FOR THE FUTURE

The potential importance of SOF as an implement for swaying international incidents continues to grow. These operations frequently require avoidance of numerous detection systems, of not only enemy but friendly forces as well. The requirement to avoid detection and compromise and to execute under almost any conditions mandates sophisticated mission planning systems.

Providing SOF with capabilities to plan for and respond to missions ranging from those of national importance to routine taskings requires capitalization on state-of-the-art automated tools for mission planning, analysis, rehearsal, and execution support to coordinate and integrate detailed administrative, operational, logistical, communications, and intelligence information necessary for successful mission execution.[56] The Mission Planning, Analysis, Rehearsal,

[56]Interviews with John R. Cox, MPARE Program Analyst, USSOCOM

and Equipment (MPARE) system is the future "architecture" planned for SOF to prepare for and execute joint missions.

Through the integration of the existing automated tools that support the execution of SOF missions, this program intends to establish protocols, procedures, standards, and other required instrumentation that will enable the connectivity, communication, and integration of the different types of packages which will constitute MPARE.

A driving force behind MPARE is the capability of planners and operators to share common and complete tactical imagery. This sharing is to occur through networking the available intelligence, imagery, charts, graphics, and other appropriate information. Such a capability would allow for "warrior pull", or the ability for planners and operators to select information from a vast pool of information. This innovation would ensure that everyone is pulling the same information, including overlays, graphics or mission plans. For example, ARSOA assets could "pull" supported SF insertion locations from their graphic overlays to insure there is no misunderstanding as to the exact locations of the actual infiltration points. Currently, mission planning systems are independent of one another and cannot support collaborative planning, especially when units are separated geographically.

1. MPARE Mission Planning

MPARE mission planning will include force, unit, and element-level planning capabilities; mission folder preparation; target area analysis, target vulnerability assessment; mixed force allocation; mixed-force mission development; timing, coordination, and deconfliction assessments. Once the initial planning, force allocations, data collection, and database generation are accomplished, the force-level systems will prepare mission tasking and supporting mission-specific data packages for use by tasked units.

2. Mission Analysis

Analysis tools will be incorporated into the architecture for COA analysis, plan effectiveness, and post-mission analysis.

3. Mission Preview, Rehearsal and Execution

Mission preview and rehearsal will include real-time generation of perspective scene displays with route and enemy order-of-battle presentations to support free roam fly, walk, swim and cruise through visual preview of areas of interest. This will be done by simulating normal vision, night vision goggle (NVG), low-light-level television

(LLLTV), forward looking infrared radar (FLIR), sonar, and ground-mapping radar views based on available terrain elevation data, imagery, and other supporting data.

During mission execution, MPARE systems will permit operators to take advantage of automated support to quickly react to situations, such as altering routes while remaining clear of enemy detection. Controlling headquarters will also be able to track and support tactical situations. MPARE may well be the "master plan" to bring combat simulation modeling out of the training closet and on to the tactical playing field. This architecture is needed now and must be validated as soon as possible in order to implement its benefits in operational SOF units.

D. RECOMMENDATIONS

1. Education

In order for combat simulation to become an integral part of SOF mission planning, commanders, planners and users need to become familiar with the basic concepts of stochastic reasoning and its implications in modern combat. As a result of the redesigned curriculum, Special Operations Low Intensity Conflict (SO/LIC) students at the Naval Postgraduate School (NPS) now take courses in deterministic and probability modeling in preparation for hands-on high

resolution simulation modeling instruction. This innovative incorporation of modeling and simulation into the SO/LIC curriculum addressing combat theory and research allows SO students to recognize the benefits of a quantitative approach to mission planning.

High resolution modeling can be taught in basic courses or more advanced courses, for Combined Armed Services Staff School (CAS3), Command and General Staff College (CGSC), and other schools where tactics and combat skills are emphasized. The NPS can provide technical expertise and courses through its distance learning programs. It is important for users to see not only combat simulation demonstrated, but also to apply it in order to understand its potential benefits. Users can learn the basic applications within approximately eight hours and become extremely proficient within about forty hours!

The potential is unlimited for the use of high resolution modeling within ARSOA. It could be an imaginative planning tool for Green Platoon[57] participants to better visualize tactical scenarios, terrain analysis and historical examination of past ARSOA missions. The more combat simulation is used, the more its applications become evident.

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[57] Initial ARSOA training for selected officers and aviators.

2. Terrain Files

It is imperative that sufficient terrain file data be kept available in case the user should have world-wide responsibilities. Proactive and intelligent assessment of future needs, including OPLAN/CONPLAN requirements, can provide the foundation for impending terrain data needs. The Defense Mapping Agency (DMA) can provide additional files, but will need time to do so. As technology and demand for terrain data improve, greater storage capabilities will become available to maintain a large terrain file repository.

3. Database Integrity

It is a lengthy and time consuming responsibility to develop and maintain an objective database. The Army's TRADOC Analysis Center (TRAC) does currently maintain a large database of friendly and enemy (mostly former Soviet) equipment.[58] More information needs to be incorporated into this database. The database manager must act as an honest broker to verify, consolidate and log all database entries. If combat simulation is to be a viable instrument in ARSOA mission planning, then databases must remain objective and as complete as possible to paint a "real world" picture.

[58] Hakala, p. 51.

E. CONCLUSIONS

Not everyone is, nor will be, an advocate of combat simulation in the mission planning process. Its training value may be evident, but its use as a SO mission planning tool may appear to some as speculative. Those who have "played with" or seen demonstrations of high resolution modeling may never have contemplated its potential as an insightful tool for implementation at the operator level. Many decision makers feel that current ways of conducting business are sufficient and that the status quo should suffice. Others believe this position is too limited given our rapidly changing technologies and conflicted world.

The world of computer games are filled with mission planning, preview and execution games. The U.S. Marine Corps is assessing off-the-shelf personal computer (PC) games as training tools.[59] Titles of operational games such as *Panzer General*, *Command and Conquer*, and *Marine Doom* offer realistic situations, a time-stress factor, and a "fun factor" which will bring the individual back for more.[60]

With these and other new and intriguing games in many homes today, a new computer-oriented generation may more readily accept the value of combat simulation. High resolution combat modeling, while not an off-the-shelf game,

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[59]See "Looking for a Few Good Games," *PC Gamer*, April 1996, pp. 79-86.
[60] Ibid., p. 84.

does offer engaging potential for users and brings the user back for more.

To validate the value of combat simulation in mission planning, we must realize that high resolution modeling is not the answer to planning and predicting mission success. Nevertheless, as Professor Wayne Hughes so eloquently states:

> …we may have understated the quality of models simply for description and understanding. The quality we want in our decision makers, apart from the willpower to which modeling can not contribute, is wisdom. Wisdom neither asks nor expects very powerful predictions. It sniffs out the alternative futures itself with the help of models to explore the possibilities. Wisdom is intelligent application of knowledge, and knowledge is understanding of phenomenon, which we call science….The train of thought that leads from explanation to understanding to prognostication to creation (inspired planning) is beyond the powers of most of us to trace…[61]

Using models will not make us tactical geniuses. It will not discover new tactics. But it can help us evaluate and validate new stratagem. As Lord Rayleigh, a great scientist said: "The higher mysteries of being, if penetrable at all by human intellect, require other weapons than those of calculation and experiment"[62]

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[61] Hughes, *Military Modeling*, p vii.

[62] Ibid., p. ix.

The role that high resolution modeling plays in the future will depend on the imagination and ingenuity of its users. Modeling alone will not make us better planners, but it can add breadth and scope to our ability to think, analyze, predict, and comprehend. It can give U.S. forces a competitive edge and help increase our combat effectiveness.

GLOSSARY

The following definitions are furnished to the acquaint the reader with terms and concepts discussed in this study. The terms appear in order of their use in the thesis.

HIGH RESOLUTION COMBAT MODELING (combat modeling or combat simulation, high resolution combat simulation) A high resolution combat model is one which includes the detailed interactions of individual combatants or weapons systems. Each combatant in a high resolution model has its own vector of state variables which describe its unique situation and its unique perception of the battlefield as the battle progressed. Interactions among combatants are resolved at the one-on-one engagement level-- often computing separately the results of each individual shot fired in the battle. The engagement models include terrain and environmental effects as well as the states of the firer and the target. The emphasis on detail makes high resolution models reasonably believable as representations of combat, but it also limits high resolution models to fairly small forces -- typically battalions. High resolution models are generally stochastic -- including uncertainties in many of the combat process submodels. [Ref: Professor Sam Parry, Naval Postgraduate School, notes from Operations Analysis class "Airland Combat Models I", 1992]

ARMY SPECIAL OPERATIONS AVIATION (ARSOA) The 160th Special Operations Aviation Regiment (SOAR) Airborne (A) is Army Special Operations Aviation (ARSOA). This unit is the Department of the Army Aviation asset assigned to the U.S. Special Operations Command (USASOC), Fort Bragg, North Carolina. The 160th SOAR (A) is comprised of three active battalions, one forward deployed company, and one SOA training company. [Ref: 160th SOAR Mission Planning Guide. P.1-1]

SPECIAL OPERATIONS (SO) Operations conducted by specially organized, trained, and equipped military and paramilitary forces to achieve military, political, economic, or psychological objectives by unconventional military means in hostile, denied, or politically sensitive areas. These

operations are conducted during peacetime competition, conflict, and war, independently or in coordination with operations of conventional, nonspecial-operations forces. Political-military considerations frequently shape special operations, requiring clandestine, covert or low visibility techniques and oversight at the national level. Special operations differ from conventional operations in degree of physical and political risk, operational techniques, mode of employment, independence from friendly support, and dependence on detailed operational intelligence and indigenous assets. [Ref: Joint Pub 3-05, p. GL-20]

MISSION PLANNING AGENT (MPA) The subordinate special operations force commander designated by the joint force special operations component commander to validate, plan, and execute a particular special operations mission. [Ref: Joint Pub 3-05.5. p. GL-8]

NATIONAL COMMAND AUTHORITY (NCA) The President and the Secretary of Defense or their duly deputized alternates or successors. [Ref: Joint Pub 1-02 and Joint Pub 3-05.3. p. GL-20]

COMBAT MODELS Simulation Models which attempt to provide a detailed mathematical representation of the actual sequence of detailed physical events that occur during combat. [Ref: Battilega and Grange, *The Military Applications of Modeling*, p. 76]

LIVE SIMULATION Includes battalion field training exercises (FTX), National Training Center (NTC) and [Joint Readiness Training Center (JRTC)] rotations which constitute the closest approximation to actual battle that can practically be achieved today. [Ref: study paper "Application of Virtual Simulation to Live Simulation Training: Demonstration of Concept" by Charles A. Gainer, USARI Aviation R&D Activity.]

VIRTUAL SIMULATION Prior to field training (live simulation) units train in mission planning, preparation, and execution with "experts". Training is conducted by NTC observer controllers (O/C) and USAAVNC staff using the Aviation Testbed (AVTB) Simnet facility. Units undergoing this training are presented with tactical and operational situations similar to those to be conducted in live

simulation. Through virtual simulation training, live simulation is more productive and effective. [Ref: study paper "Application of Virtual Simulation to Live Simulation Training: Demonstration of Concept" by Charles A. Gainer, USARI Aviation R&D Activity.]

CONSTRUCTIVE SIMULATION The use of computer models such as Janus, Joint Tactical Simulation (JTS) or the Joint Conflict Model (JCM) for analysis in mission preparation. [Ref: Conversation with Charles A. Gainer at USARI Aviation R&D Activity.]

STOCHASTIC Probabilistic in nature; Of, relating to, or characterized by conjecture; Involving or containing random variable or variables; involving chance or probability. [Ref: Giordano and Weir, A First Course in Mathematical Modeling, p. 121; Microsoft Bookshelf.]

JOINT DOCTRINE Prepared under the direction of the Chairman of the Joint Chiefs of Staff. Sets forth principles and military guidance to govern the joint activities and employment of the Armed Forces of the United States [Ref: Joint Pub 3-05]

JOINT TACTICS, TECHNIQUES and PROCEDURES (JTTP) The actions and methods that implement joint doctrine and describe how forces will be employed in joint operations. Joint Pub 3-05 provides broad doctrinal guidance for strategic and operational joint employment of SOF. Supporting JTTP publications (Joint Pubs 3-05.3 & 3-05.5) have been developed to amplify this joint special operations doctrine. [Ref: Joint Pub 3-05, I-2]

SPECIAL RECONNAISANCE (SR) Reconnaissance and surveillance actions conducted by special operations forces to obtain or verify, by visual observation or other collection methods, information concerning the capabilities, intentions, and activities of an actual or potential enemy or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area. It includes target acquisition, area assessment, and post-strike reconnaissance. [Ref: Joint Pub 3-05, p. GL-11]

DIRECT ACTION (DA) Short-duration strikes and other small-scale offensive actions by special operations forces to seize, destroy, capture, recover, or inflict damage on designated personnel or material. In the conduct of these operations, special operations forces may employ raid, ambush, or direct assault tactics; emplace mines and other munitions; conduct standoff attacks by fire from air, ground, or maritime platforms; provide terminal guidance for precision-guided munitions; and conduct independent sabotage. [Ref: Joint Pub 3-05.5, p. GL-5]

MISSION TASKING (MITASK) A directive that assigns a mission to a subordinate commander; provides essential planning guidance, and directs the initiation of mission planning. A mission tasking may be issued as a warning order, planning order, alert order, or execute order. [Ref: Joint Pub 3-05.5, GL-8]

EARLIEST ANTICIPATED LAUNCH TIME (EALT) The earliest time expected for a special operations tactical element and its supporting platform to depart the staging or marshaling area together enroute to the operations area. [Ref: Joint Pub 3-05.5, p. GL-5]

JOINT FORCE COMMANDER (JFC) A general term applied to a commander authorized to exercise Combatant Command (command authority) or operational control over a joint force. [Ref: Joint Pub 1-02]

APPENDIX A: JANUS FEATURES

CAC - A feature giving the user the capability to draw, store recall, and display Command and Control (CAC) overlays.

Checkpoint - An option that records the state of the simulation at regular intervals. In the event of an abnormal termination (of a scenario), a user can restart the simulation from the most recent checkpoint instead of from the beginning. (This would be extremely useful for a mission planner to look at modeled actions on the objective from release point inbound to the target.)

Controller Workstation - The Controller Workstation (CONWOR) is an "observer" workstation. It permits the user to see nearly all events taking place during a scenario run. Since the controller workstation displays ALL sides, the user may watch all sides, one side only, one group of a side only, one task force of a side only, or one specific unit while the scenario is running.

Defilade - Units may be in one of three protective categories: exposed, in partial defilade, or full defilade. Moving units are always exposed, but automatically go into partial defilade soon after stopping. The user controls full defilade manually.

Direct Fire Engagements - Direct Fire systems engage enemy systems automatically. To assess results, Janus considers database settings like weapons capabilities, enemy vulnerability, and Probability of Hit and Probability of Kill (PH/PK) tables, as well as the systems' aspect (stationary/moving, head-on/flank) and intervisibility.

Help - Users may ask for help for all menu items and have help messages displayed on the screen.

Holdfire - Users may designate direct-fire units not to fire.

Indirect Fire - Users may plan and fire indirect fire missions, including mortars. Options include scheduled or on-call missions, number of volleys, type of munitions, and parallel or converged sheaf. Missions may be normal, timed or priority. Users may alter or cancel planned missions. Users may also plan Target Reference Points (TRPs). Users may create or delete TRPs. Users may also "REPEAT" currently firing or previously fired missions.

Line of Sight - Users may check the Line of Sight (LOS) of a system at any location in the current view display. The user may also use this function while deploying units by determining the line of sight from a point on the display before deploying the unit.

Mount/Dismount - Users may mount units on designated carriers consistent with volume and weight limits. Mounted units dismount on command.

Movement - Users establish movement routes for air and ground units to follow. Once established, routes may be copied to other units, changed, and deleted.

Obscuration - Janus models the effects of smoke and dust. Additionally, smoke and dust clouds build, drift with the wind, and dissipate.

Obstacles - Users may emplace minefields, abatis, craters, and ditches.

Prepos - Units may construct and occupy prepared two-step fighting positions.

Reports - Users may display a variety of reports: everything from scheduled artillery missions to casualty reports.

Run Speed - The Run Speed function allows the user to change the speed at which the simulation runs. The default run speed factor of 1.00 runs the simulation at or near real time. The higher the run speed factor the faster the simulation will run. A run speed factor of 3.00 (up to a maximum of 5.00) will run at approximately three minutes of simulated time for every one minute of real time.

Task Organization - Users may group their units into task forces to accomplish a particular mission.

UTM Grid - Janus will display the Universal Transverse Mercator.

Zoom - A feature allowing the user to magnify any part of the screen display. Thirteen levels of magnification are available, plus the additional level that corresponds to the standard military scale of 1:50,000.

APPENDIX B: CHARACTERISTICS OF SPECIAL OPERATIONS (SO) AND SPECIAL OPERATIONS FORCES (SOF)

(See Joint Pub 3-05, pp. I-4-6.)

Characteristics of Special Operations Distinguishing properties which accrued distinguish them from conventional operations.

a. Are principally offensive, usually of high physical and political risk, and directed at high-value targets, critical, and often perishable targets. They offer the potential for high returns, but rarely a second chance should a first mission fail.

b. Are often principally politico-military in nature and subject to oversight at the national level. **Frequently demand operator-level detailed planning** and rapid coordination with other commands, services and government agencies.

c. Often require responsive joint ground, air, and maritime operations and the C2 architecture permanently resident in the existing SOF structure.

d. May frequently be covert or clandestine.

e. Are frequently prosecuted when the use of conventional forces is either inappropriate or unfeasible for either military or political reasons.

f. Rely on surprise, security, and audacity and frequently employ deception to achieve success.

g. Are often conducted at great distances from established support bases, requiring sophisticated communications and means of infiltration, exfiltration, and support to penetrate and recover from hostile, denied, or politically sensitive areas.

h. May require patient, long-term commitment in a given operational area to achieve national goals through security assistance and/or nation assistance activities or extended UW operations. Often, the training and organization of indigenous forces are required to attain these objectives.

i. Frequently require discriminate and precise use of force; a mix of high and low technology weapons and equipment; and

often rapid deployment, acquisition, and employment of weapons and equipment not standard for other DOD forces.

j. Are primarily conducted by specially recruited, selected, and trained personnel, organized into small units tailored for specific missions or environments. Missions often require detailed knowledge of the culture(s) and languages(s) of the country where employed.

k. Require detailed intelligence, thorough planning, decentralized execution, and rigorous detailed rehearsal.

Characteristics of Special Operations Forces The demands of SO require forces with attributes that distinguish them from conventional forces. Commanders must be familiar with these characteristics to ensure that missions selected for SOF are compatible with their capabilities. (Joint Pub 3-05, pp. I-5,6.)

a. Personnel may undergo lengthy selection processes or extensive mission-specific training programs above basic military skill training to achieve entry level SO skills.

b. Units are small and necessarily maintain high personal and professional levels of maturity and experience, usually in more than one principal field. The complex SO selection and long lead time objective and subjective maturation process make any rapid replacement of personnel or capabilities very difficult.

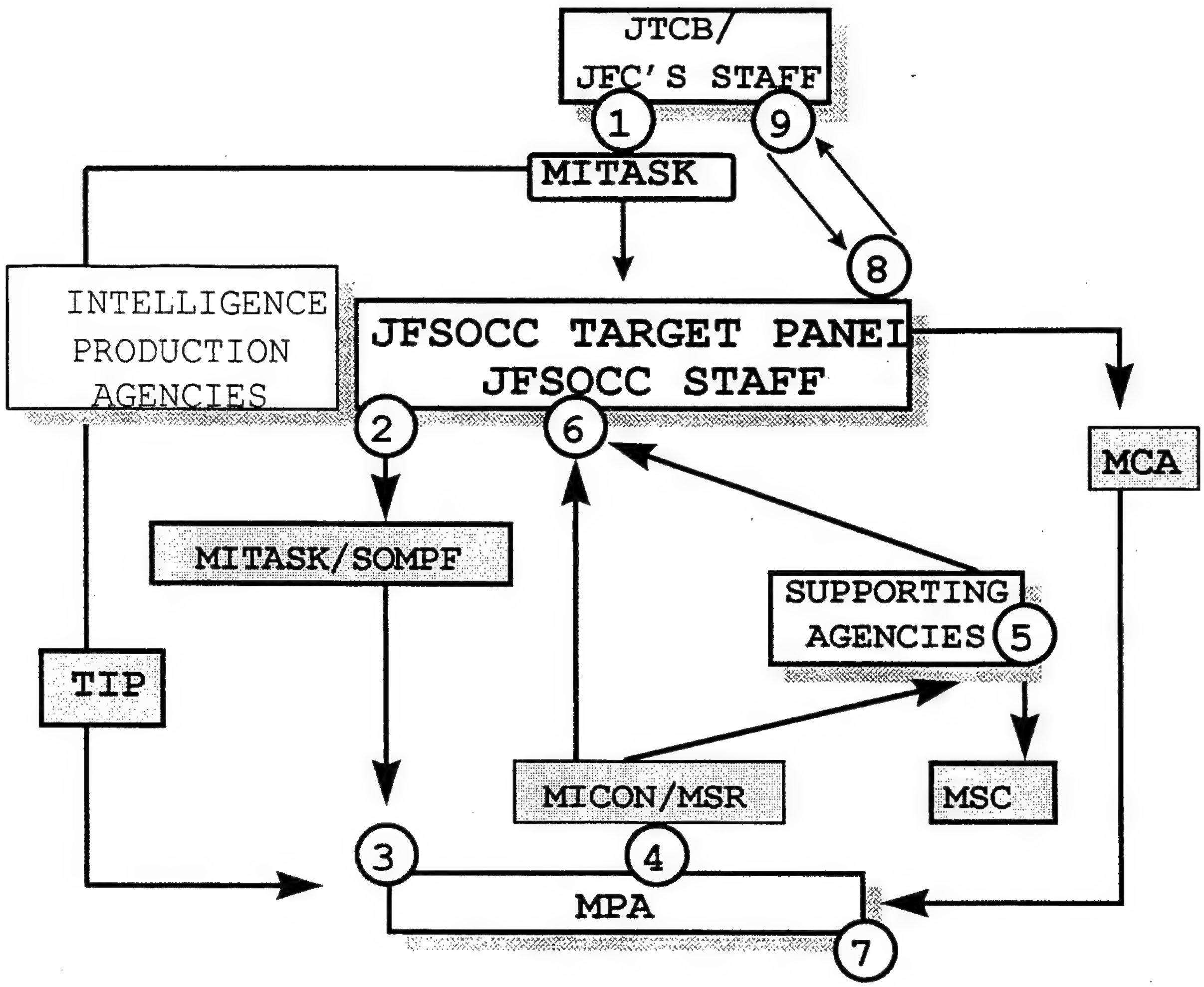
c. SOF are often organized jointly and routinely plan, execute, command, and control operations from a joint perspective.

d. Area orientation is often required and includes the capability to execute foreseeable operations in the full range of the area's environmental conditions. Detailed area orientation, including mastery of language and culture, requires long-term, dedicated training and may be applicable to air, ground, and maritime SOF units, depending upon mission assignment.

e. To develop and maintain skills, SOF should train and exercise under conditions resembling the operational environment in which they intend to operate.

APPENDIX C: TIME-SENSITIVE PLANNING CYCLE AND TARGETING DIAGRAM.

(See *Joint Pub* 3-05.5)



(Diagram Annotations on the Following Page.)

TIME-SENSITIVE PLANNING CYCLE AND TARGETING DIAGRAM ANNOTATIONS

1. JFC component commanders or national-level intelligence assets identify potential targets. Targets are selected by the JFC's staff or Joint Targeting Coordination Board (JTCB) if used and assigned to the JFSOCC by MITASK. IPAs update the Target Intelligence Package (TIP) or assimilate required intelligence. MPAs forward intelligence requests through the JFSOCC, other component commanders, or JFSOCC to the theater intelligence agencies who then request national-level intelligence support if necessary. The required intelligence is then disseminated directly to the requesting organization, depending on the time factor and operational security situation.

2. The JFSOCC, JFSOCC staff or JFSOCC target panel perform and abbreviated feasibility assessment (FA) and send a MITASK to the MPA. If a Special Operations Mission Planning Folder (SOMPF) was prepared in the deliberate planning cycle, the JFSOCC will pass it to the MPA with the MITASK. If the MPA does not validate the target SOF execution, then the MPA must inform the JFSOCC and await further guidance.

3. If the target is validated, then the MPA develops the MICON and coordinates MSRs with supporting agencies.

4. The MPA sends the MICON to JFSOCC and MSRs to supporting agencies, with information copies to the JFSOCC.

5. The supporting agencies confirm MSRs by MSC.

6. The JFSOCC reviews and approves the MICON by MSA.

7. MPA coordinates execution planning with the executing SO unit and supporting agencies.

8. The JFSOCC recommends to the JFC that the mission be approved, disapproved, modified, or canceled.

9. The JFC makes a decision on the mission by EXORD. The EXORD is passed through the JFSOCC to the MPA.

APPENDIX D: TIME SENSITIVE MISSION PLANNING CYCLE

(See *Joint Pub 3-05.5*)

Phase 1: Objectives and Guidance. The **MISSION TASKING** (MITASK) initiates the time-sensitive SO planning process and should be sent to the operational component 96 hours before **EARLIEST ANTICIPATED LAUNCH TIME** (EALT). The MITASK should be transmitted within 4 hours of mission receipt. The **JOINT FORCE COMMANDER** (JFC) passes mission guidance to the JFSOCC by a MITASK. The MITASK may (1), task new or preplanned targets requiring updates; (2) grants direct liaison authorization (DIRLAUTH) between MPA and Intelligence Production Agency (IPA). Upon MITASK receipt, the JFSOCC analyzes the mission for tasks and feasibility and then sends a MITASK to the MPA(s), supporting agencies, and IPA and authorizes DIRLAUTH between requisite organizations. The IPA provides the MPA and supporting agencies with all immediately available intelligence within 12 hours of MITASK receipt.

Phases 2 and 3: Target Development and Weaponeering. The combination of these two stages are conducted more briefly, with less detail and more fragmentary data under time-sensitive targeting conditions. The MPA begins its estimate process and mission concept (MICON) development, and coordinates with the supporting agencies to examine insertion and extraction options. The IPA continues to provide intelligence products as they become available. No later than 72 hours before the EALT, the MPA transmits the MICON to the JFSOCC. The MPA simultaneously submits mission support requests (MSRs) to the supporting agencies, with an information copy to the JFSOCC. No later than 48 hours before the EALT, the supporting agencies send mission support confirmation (MSCs) to the MPA, with information copies to the JFSOCC.

Phase 4: Force Selection. The JFSOCC may approve, alter or disapprove MICONs and MSRs and then transmits Mission Concept Approval (MCA) to the MPA within 8 hours of MICON receipt. Supporting agencies receive information copies. Disapproved MICONs should include guidance and a suspense for a new MICON. Normally, the type of force (e.g., SFODA, SEAL platoon) has already been selected and specified in the MITASK issued by the JFSOCC.

Phase 5. Mission Planning. No later than 24 hours before the EALT, the JFSOCC should issue the Execute Order

(EXORD). Changes to the mission after transmission of this confirmation may result in mission delay. Other elements continue detailed mission planning and preparation. The IPA continues to be integrally involved in the final phase of planning. The supporting agencies obtain the latest weather and intelligence updates, prepare and stage platforms for the mission.

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